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ONTARIO GEOLOGICAL SURVEY

Open File Report 6033

Geochemical Response of Surficial Media,  
North and East Ranges, Sudbury Basin

by

A.F. Bajc and G.E.M. Hall

2000

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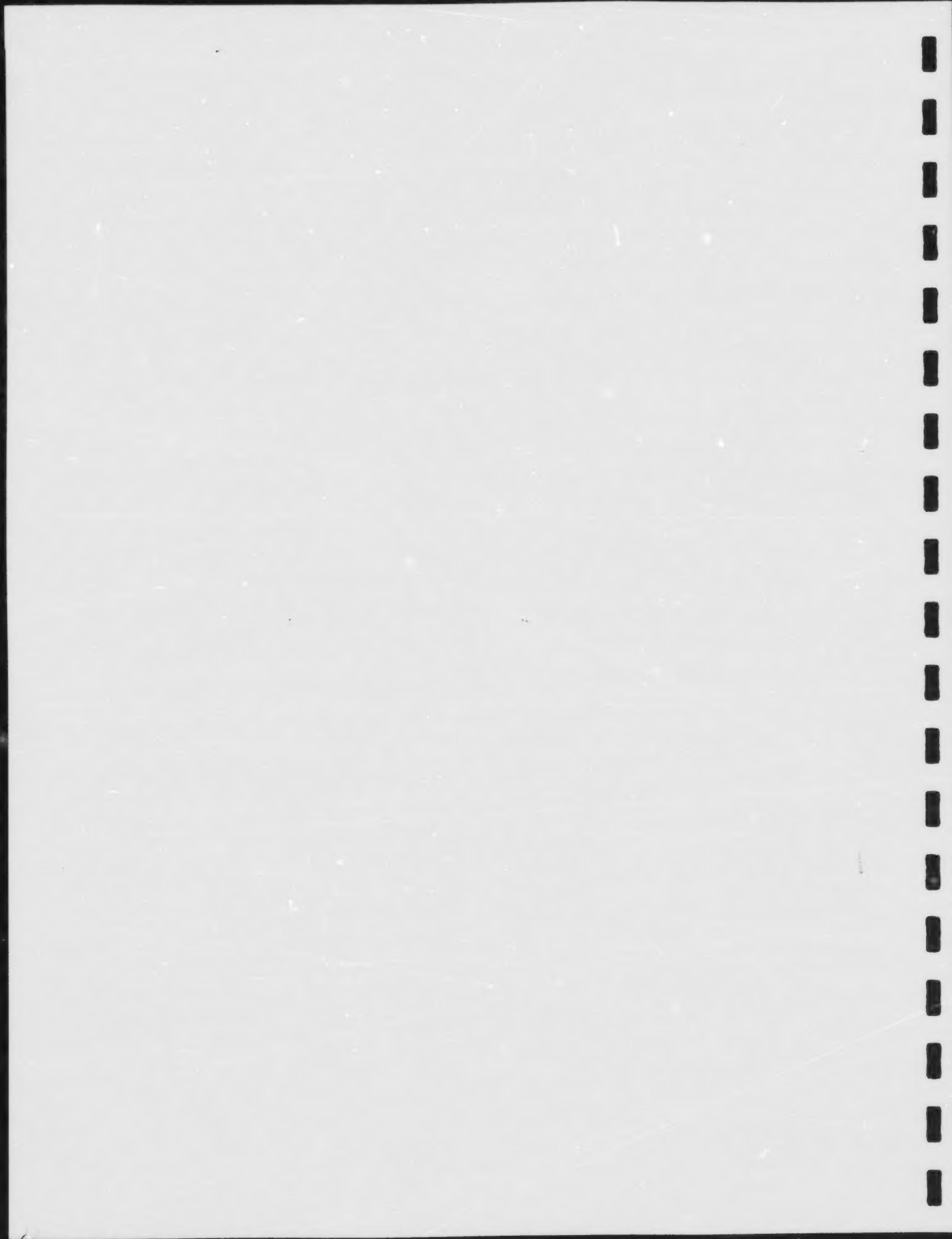
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## Abstract

A multi-year study of Quaternary geology and drift geochemistry along the north and east ranges of the Sudbury basin was undertaken to evaluate the effectiveness of surficial geochemistry for mineral exploration in the Sudbury mining camp, an area strongly affected by anthropogenic sources of contamination. The project was undertaken in cooperation with the Mineral Resources Division of the Geological Survey of Canada. The federal portion of the project was funded under the Canada-Ontario Northern Ontario Development Agreement (NODA).

The project was specifically designed to evaluate the geochemical response of various surficial media to Ni-Cu-PGE mineralization, differentiate natural from anthropogenic geochemical responses and provide practical information on the geochemical behaviour of these elements in the surficial environment.

These objectives were met by undertaking: 1) 1:20 000 scale Quaternary geology mapping; 2) property- and regional-scale sampling of surficial media, including humus, vegetation, B- and C-horizon till; 3) high-resolution, profile sampling of selected, geochemically anomalous sites; and 4) the application of selective and standard leaches to the various media collected.

The results presented in this report can be used not only as an aid to mineral exploration in the Sudbury mining camp but to any Ni-Cu-PGE exploration program within the glaciated regions of the world. The results of regional and property-scale sampling programs are presented as proportionally-sized dot plots which can be used to quickly identify areas of anomalous response. This information provides baseline geochemical data for both environmental and mineral exploration applications. The geochemical and mineralogical datasets contain a number of potentially significant exploration targets. These anomalies should be investigated in conjunction with existing geoscience datasets to determine their potential significance. High priority targets should be followed up with higher-density till sampling and prospecting to refine exploration targets.

A companion digital dataset, consisting of locational and site description information and heavy mineral, pebble count and geochemical results is being released in conjunction with this Open File Report as Miscellaneous Release-Data 61.



# **Geochemical Response of Surficial Media, North and East Ranges, Sudbury Basin.**

**A.F. Bajc**  
**Sedimentary Geoscience Section**  
**Ontario Geological Survey**

**G.E.M. Hall**  
**Mineral Resources Division**  
**Geological Survey of Canada**

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# Introduction

## PROJECT LOCATION AND OBJECTIVES

A multi-year study of Quaternary geology and drift geochemistry along the north and east ranges of the Sudbury basin was initiated in 1992 as part of the Northern Ontario Development Agreement (NODA). The Sudbury mining camp was chosen for study because of its world famous Ni-Cu sulphide ores and contained precious metals. The study was restricted to the north and east ranges because of their relatively undisturbed present state. The study area consists of 13½ townships (~1300 km<sup>2</sup>) encompassing the northern half of the Sudbury Igneous Complex (SIC) and related offset dikes (Figure 1).

The study was undertaken to: 1) evaluate the effectiveness of surficial geochemistry for mineral exploration in the Sudbury mining camp, an area strongly affected by anthropogenic sources of contamination; 2) provide baseline geochemical data for environmental applications; and 3) provide practical information on the geochemical behaviour of nickel, copper and the platinum group elements (PGEs) in the surficial environment. Particular attention was directed towards the evaluation of the geochemical response of surficial media to PGE mineralization and to the differentiation of natural from anthropogenic geochemical signatures.

The aforementioned objectives were achieved by: 1) 1:20 000 scale Quaternary geology mapping; 2) property- and regional-scale sampling of surficial media; 3) profile sampling at sites predetermined to have anomalous Ni-Cu-PGE geochemical signatures; and 4) the application of selective leaches to the various media sampled.

Detailed surficial geological mapping was undertaken to establish a framework of Quaternary geology for mineral exploration. The study area is covered by 4, 1:20 000 scale Quaternary geology maps (Bajc 1997a-d). In addition to providing detailed maps showing the distribution of surficial materials within the study area, the Quaternary mapping is intended to: 1) provide a detailed analysis of ice flow across the region; 2) document the Quaternary stratigraphy preserved within the study area; and 3) provide information critical for the evaluation of surficial deposits and the soils developed on them for programs of mineral exploration using drift geochemistry.

High density and, in some cases, ultra-high density sampling was conducted at 6 sites known to contain Ni-Cu-PGE mineralization (Figure 2). This was done in an attempt to document the magnitude, shape and character of response in the immediate vicinity of mineralization and apply this information to the interpretation of the regional datasets. Lower density, regional sampling was conducted throughout the study area in an attempt to: 1) document the background geochemical signatures over different bedrock domains; 2) evaluate regional lithologic and geochemical dispersal patterns across the study area; and 3) identify new exploration targets.

The nature of mobilization and redistribution of Ni-Cu-PGEs and associated elements within the zone of weathering, and the residence sites of these metals within the various sample media were established. This was accomplished, in part, by sampling at different depths, sites with anomalous metal concentrations and by the application of selective leaches to various size fractions of these samples. These procedures assisted in the differentiation of natural from anthropogenic geochemical signatures for the various media sampled.

A companion digital dataset is being released in conjunction with this report as Miscellaneous Release-Data 61 (Bajc and Hall 2000). The data release contains sample location and site description information, heavy mineral data, pebble count data and geochemistry.

## ACKNOWLEDGEMENTS

This project was undertaken co-operatively with the Mineral Resources Division of the Geological Survey of Canada. The federal portion of the project was funded under the Northern Ontario Development

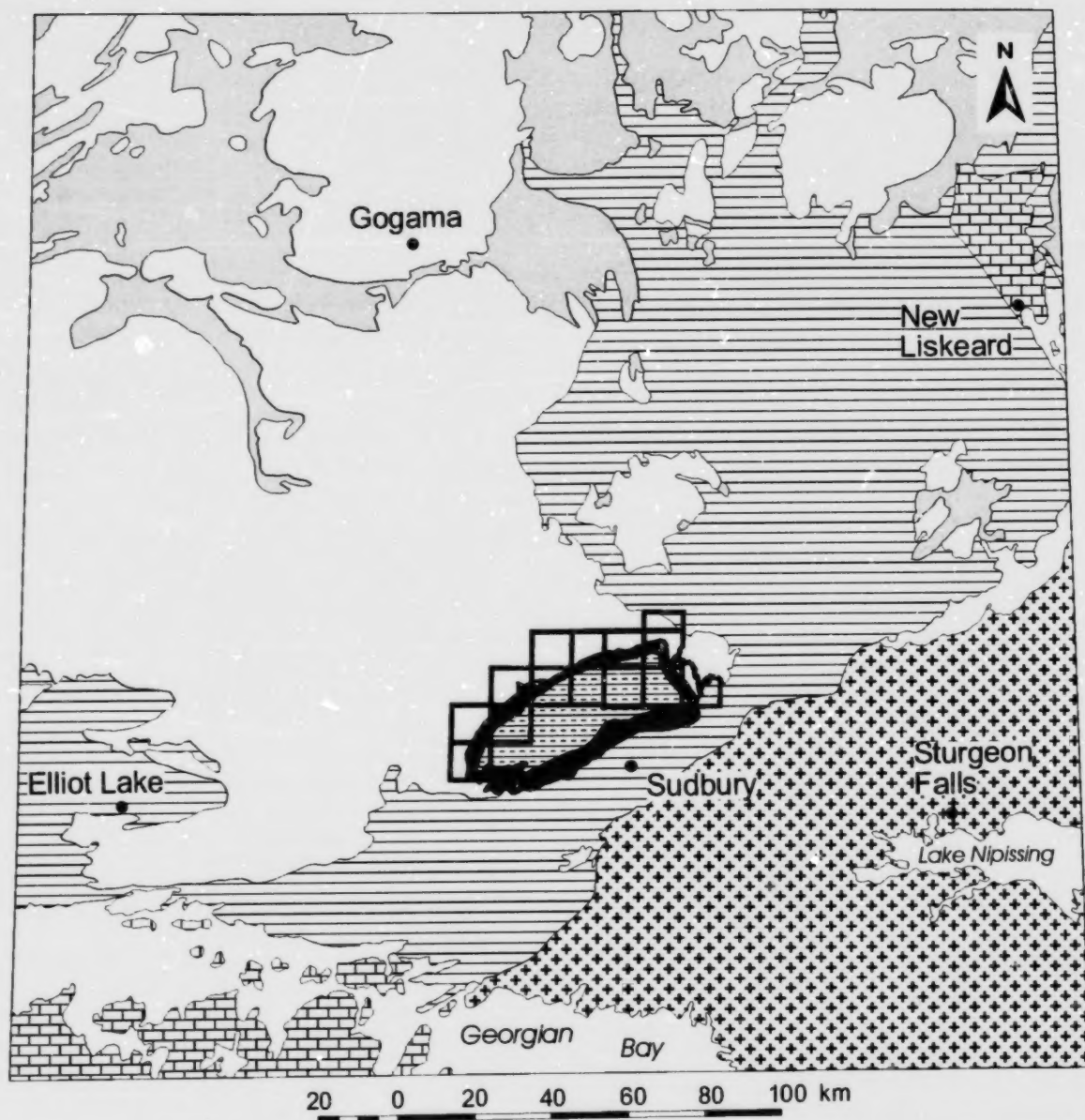


Figure 1. Location map of study area including regional bedrock geology.

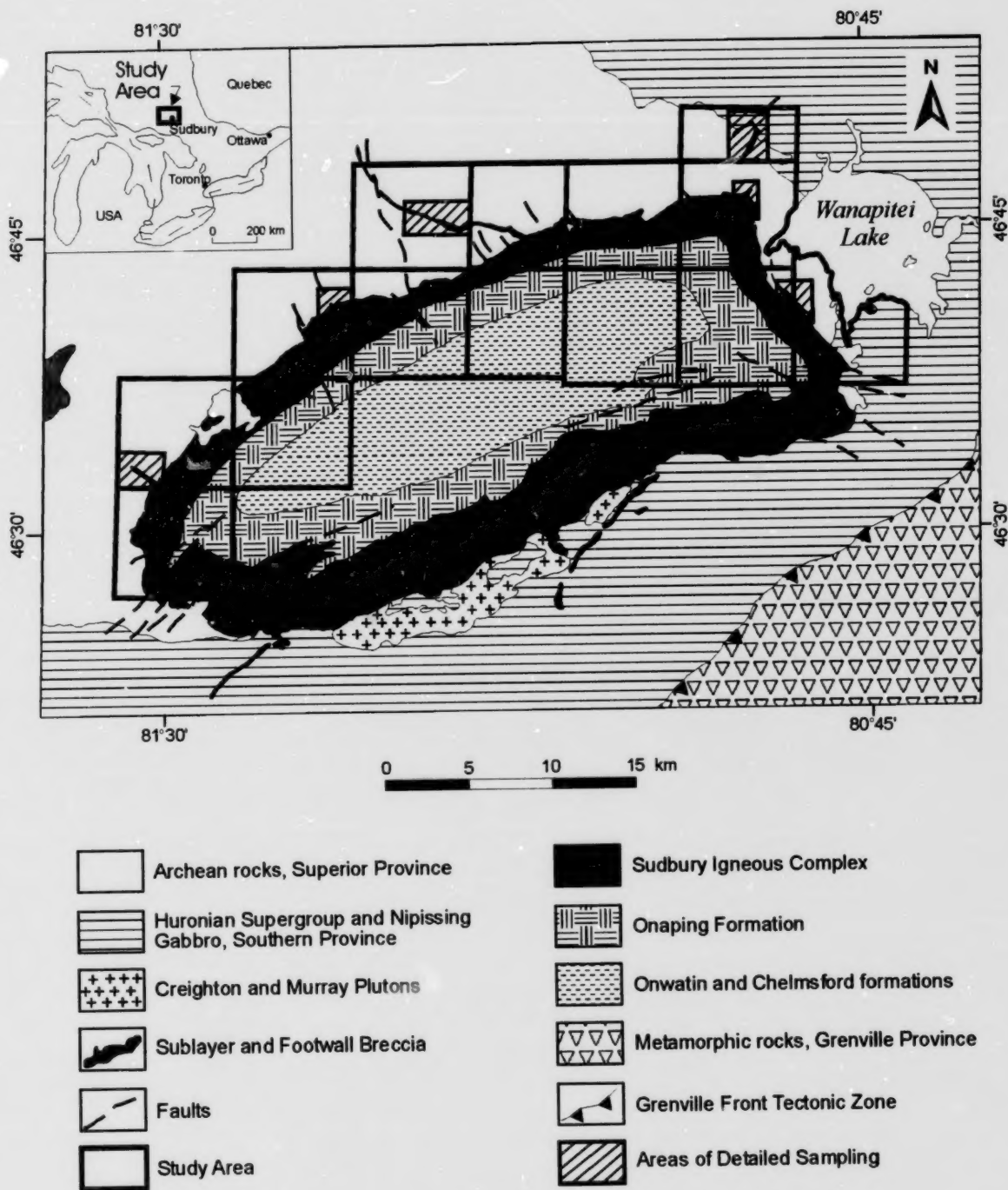


Figure 2. Bedrock geology of the study area highlighting the locations of areas of detailed sampling.



Agreement (NODA). Both INCO and Falconbridge Limited are greatly acknowledged for allowing access to and providing information on the geology of their respective properties. Special thanks go out to Alice MacLaurin of the Geological Survey of Canada for her professionalism and enthusiasm in ensuring that analytical requirements were met. Colin Dunn of the Geological Survey of Canada assisted with the design and implementation of the vegetation sampling program. Bill Coker and Christine Kaszycki provided invaluable advice with regard to project design and field geology. Chris Meandro, Jeff Kitching and Chris Hamblin provided competent assistance in the field. Catherine Searcy assisted with data plotting.

## Regional Setting

### BEDROCK GEOLOGY AND MINERALIZATION

The elliptically-shaped Sudbury structure, which is famous for its worldclass Ni-Cu sulphide ores, is situated northwest of the Grenville Front along the boundary of the Superior and Southern geological provinces (Figure 2). It measures approximately 60 km long and 23 km wide with its long axis oriented to the east-northeast. Archean granites, granite gneisses and metavolcanic rocks of the Superior Province lie to the north and northwest of the Sudbury Structure, whereas a predominantly clastic Huronian succession with some metavolcanic rocks of the Southern Province surrounds the remaining portions of the basin (Dressler 1984).

The Sudbury Structure consists of: 1) the Sudbury Igneous Complex (SIC), a funnel-shaped, differentiated, mafic to felsic intrusion; 2) the overlying Whitewater Group which consists of heterolithic breccias, mudstones and wackes of the Onaping, Onwatin and Chelmsford formations, respectively; and 3) brecciated footwall rocks which occur along the outer edges of the SIC. Ni-Cu-PGE mineralization occurs primarily along the contact of the SIC and the surrounding footwall rocks as well as in offset dikes that both radiate out from and parallel the outer edges of the SIC. New ore bodies are now being discovered in footwall rocks immediately adjacent to the SIC.

Sudbury orebodies occur in 3 diverse geological environments or settings, each producing compositionally distinct ores (Morrison et al. 1994; Jago et al. 1994): 1) **Contact ores** occur at the base of the SIC, most frequently within large depressions in the underlying wall rocks. They are characterized by their relatively low Cu:Ni ratios ( $<1$ ) and low precious metal contents. The Victor, Nickel Rim, Whistle and most of the Levack ore bodies fall into this category; 2) **Offset ores** occur in quartz diorite offset dikes which either radiate out from or parallel the outer edges of the SIC and are characterized by their higher Cu:Ni ratios ( $\sim 1$ ) and enriched precious metal contents relative to contact ores. The Nickel Offset and Milnet mine ore bodies which, respectively, occur in the Foy and Parkin offsets, are examples of offset-type ores; and 3) **Footwall ores** usually occur within 1 km of the SIC within zones of Sudbury Breccia and associated fracture systems. These ores are distinguished by their extremely high Cu:Ni ratios ( $>>1$ ) and contained precious metals. The deep Cu zone of the Strathcona mine, the McCreedy East Footwall orebody, the Victor Deep orebody and the undeveloped Barnet property in Levack Township are examples of footwall-type ores in the north and east ranges.

Ni and Cu are the 2 main ore-forming elements in the Sudbury mining camp. Co, Pt, Pd, Au and Ag are extracted as bi-products and As, Te, Bi, Pb, Sb and Se occur at elevated concentrations and are therefore important pathfinder elements (Boyle 1974). The most common mineral species found in Sudbury ores include: pyrrhotite; pentlandite; chalcopyrite; magnetite; and pyrite. A more complete listing of mineral species is contained in Naldrett (1984). Michenerite ( $\text{PdBiTe}$ ), moncheite ( $\text{PtTe}_2$ ) and sperrylite ( $\text{PtAs}_2$ ) form the most important platinum group element minerals.

### PHYSIOGRAPHY

The study area can be subdivided into 2 distinct physiographic regions. These regions, informally referred to as the "north range" and the "valley", display different topographic signatures. The "valley", which is

underlain by the relatively flat-lying, Onwatin and Chelmsford formations, is a flat to gently undulating glaciolacustrine/glaciofluvial plain with local relief generally not exceeding 15 m. Most of the relief is attributable to the outcrop pattern caused by broad warpings of the Chelmsford Formation as well as to downcutting of the Vermilion River through glaciofluvial/glaciolacustrine deposits.

The contact between the "valley" and the "north range" lies just north of the Vermilion River at the contact between the Onaping and Onwatin formations. The more competent rocks of the Onaping Formation, the SIC and the footwall granites and granite gneisses form the rugged uplands of the "north range". Major north-northwest trending faults, now occupied by south-flowing rivers, cut across the "north range" and add over 100 m to the local relief.

## ICE FLOW RECORD

Ice flow indicators, consisting of glacial grooves and striae, chatter marks, crag and tail features and roches moutonnées, define a late-glacial ice flow pattern across the Sudbury region that was strongly controlled and/or affected by regional topographic trends (Figure 3). Ice flow across the uplands of the north range was towards the south-southwest at 170° to 210°. A progressive shift towards the southwest (220° to 245°) out of the Wanapitei Lake basin and down the axis of the Sudbury basin occurred within the "valley" in response to drawdown of the thinning ice sheet into low-lying areas.

At a few localities along the north rim, evidence for an older, southwesterly ice flow event is preserved on protected bedrock surfaces and leeside facets. The magnitude of glacial dispersal associated with this earlier event is not known. Similar, older, westerly ice flow patterns have been observed over large portions of northeastern Ontario and western Quebec (Veillette and McClenaghan 1996) where they have been attributed to the ice flow patterns associated with the inception and culmination of the Labradorean sector of the Laurentide Ice Sheet during the Wisconsinan glaciation.

## SURFICIAL DEPOSITS AND FEATURES

Observations on the surficial deposits and features that occur within the study area were gathered as part of the detailed Quaternary geology mapping program. Quaternary maps, released at a scale of 1:20 000, are available as Ontario Geological Survey Maps 2519 to 2522 (Bajc 1997a-d).

The Quaternary deposits observed within the study area are primarily a product of Late Wisconsinan ice retreat. A large, proglacial lake (glacial Lake Algonquin) fronted the retreating ice margin within the Sudbury basin. The deposits and landforms preserved within and adjacent to the basin reflect this environment of deposition. Extensive accumulations of stratified, glaciofluvial and glaciolacustrine deposits occupy low-lying areas both within the Sudbury basin as well as in narrow, structurally-controlled valleys that both radiate outward from and parallel the outer rim of the basin. Depths to bedrock derived from waterwell records for the Onaping and Vermilion river valleys as well as for large parts of Hanmer, Capreol and MacLennan townships commonly exceed 50 m and occasionally exceed 100 m. Upland areas are largely bedrock-dominated and, only locally, contain pockets of thick drift.

Glacial till is the most common surface deposit within these upland areas. It usually occurs as a thin, discontinuous veneer over bedrock (<1 m) with thicker accumulations occurring within swales separating bedrock knolls and ridges. There are, however, isolated areas (e.g., along the west shore of Wanapitei Lake) where extensive, continuous till cover masks underlying bedrock topography.

Three distinct till facies, each having a different landform association, have been recognized across the study area. These include: 1) subglacially-deposited till forming ground moraine; 2) ice-marginal flow till forming recessional moraine; and 3) supraglacial meltout till forming hummocky moraine. Their properties have been diagnosed primarily from shallow test pit exposures, roadcuts and exploration trenches. At these shallow depths, the tills are generally loose and exhibit an orangy-brown to

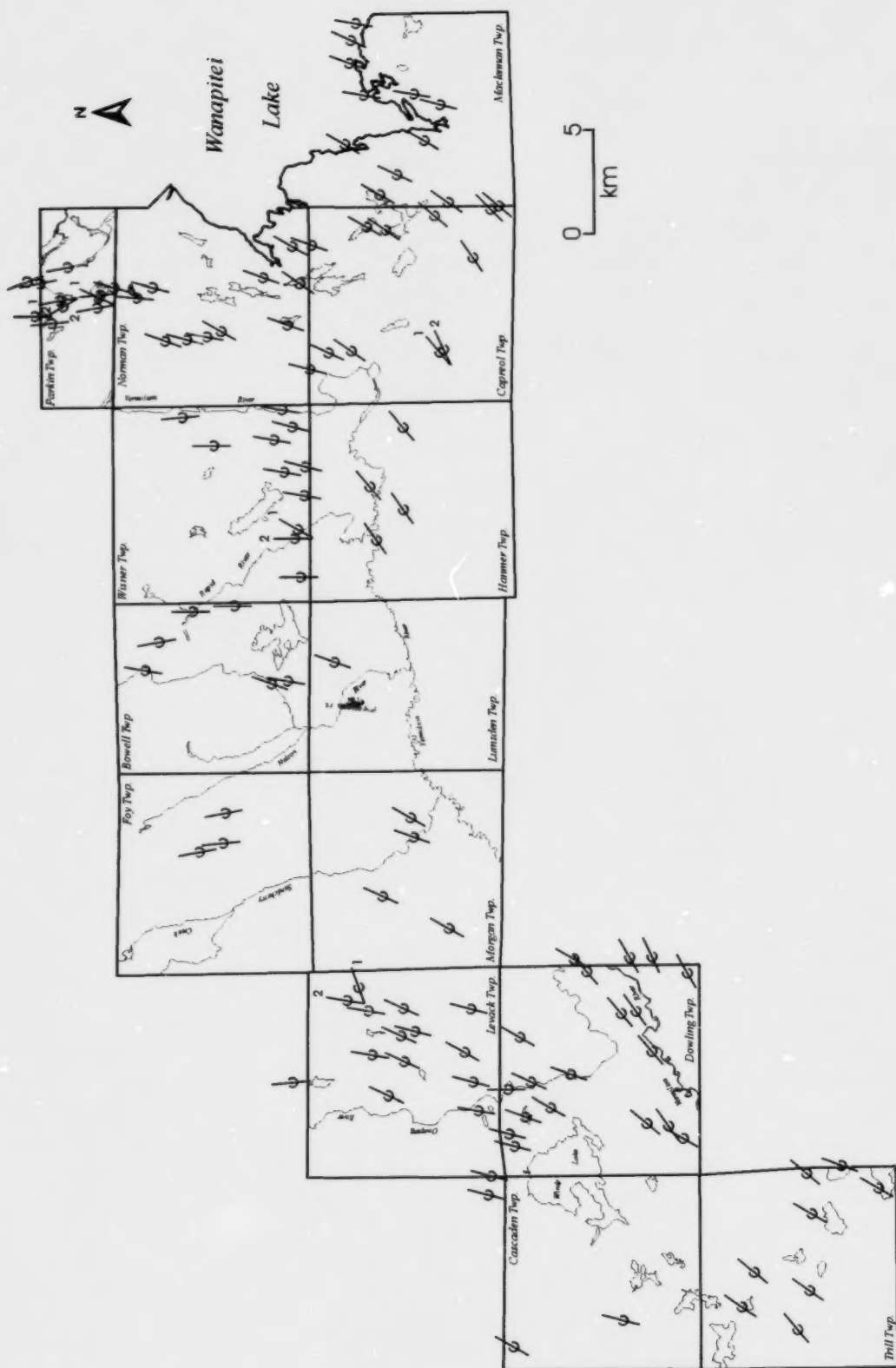


Figure 3. Regional ice flow patterns across the study area.



brownish-grey to buff-grey colour depending upon the degree of oxidation. They typically contain very low concentrations of matrix carbonate (<1% total carbonate).

The properties of subglacially-deposited till vary considerably across the study area, a reflection of the great diversity of source materials within the region. Tills collected from areas dominated by coarse crystalline rock types (i.e., SIC and Levack gneiss) in general have a sand-rich matrix and contain moderate to high concentrations of stone. Tills collected from regions underlain by Huronian metasedimentary rocks or containing clasts dominated by these lithologies have, for the most part, a fine-textured matrix (i.e., higher silt and clay content) and contain moderate to low concentrations of stone. For example, argillaceous metasedimentary rocks of the Cobalt embayment occur over large areas both within and up-ice of the Wanapitei Lake basin (Figure 1). Tills collected from the southwest shore of the lake clearly reflect the fine-grained nature of these source materials containing over 60% combined matrix silt and clay (50% silt and 10% clay). However, tills coarsen rapidly towards the southwest in response to dilution from coarse-crystalline intrusive lithologies of the Sudbury Igneous Complex.

Extensive accumulations of flow till occur within discrete morainic ridges which formed along temporary stillstand positions of the retreating ice margin. The "Cartier I Moraine" is the most notable ice-marginal position within the study area extending from the Sudbury airport in MacLennan Township, northwest towards the town of Capreol, then westward along the southern edge of the north range, to the town of Cartier on Highway 144. The feature is remarkably continuous; broken, only locally, by glaciofluvial systems and scattered driftless areas. It usually occurs as a single ridge, 5 to 10 m high, composed largely of bouldery till. Deposits of ice-contact stratified drift are usually intimately associated with the morainic feature. Locally, multiple ridges have been observed and probably formed in response to slight readjustments of the ice margin. Other, less continuous morainic segments have also been mapped within the study area. As with the Cartier I Moraine, these features are composed largely of bouldery, flow till and contain some beds and lenses of stratified sand and gravel. The till is generally loose, sandy, deficient in fines and quite often is weakly bedded. The surfaces of the morainic ridges are usually littered with large boulders (Figure 4). Compositionally, these features reflect both local and distal bedrock sources.

A large zone of hummocky, ice stagnation moraine in Cascaden Township extends westward from Windy Lake to the north end of Ministic Lake. The hummocks of supraglacial debris, which in some cases reach heights of 5 to 10 m, occur in low-lying areas within the Archean footwall and are composed of a melange of ice-contact stratified drift and stony diamicton. Clasts account for up to 75% of the total volume of diamicton and are mostly angular in shape. Pebble lithologies are dominated by granitic gneisses; however, both fine-grained mafic intrusive and extrusive lithologies of probable distal origin are present at significant levels. This zone of hummocky ice stagnation moraine occurs along the western edge of a large re-entrant whose axis extends southwestward out of Windy Lake into south-central Trill Township. A broad zone of inactive ice, possibly forming within a broad shear zone that developed between faster flowing ice within the Sudbury basin and slower flowing ice on the north rim, was left on deglaciation to melt out in place producing the hummocky moraine. Shallow waters of glacial Lake Algonquin fronted the eastern margin of this zone of ice stagnation during the formation of the Cartier I Moraine.

Deposits of ice-contact stratified drift occur as: 1) isolated esker ridges and/or esker complexes consisting of anastomosing ridges marking the former position of subglacial and englacial meltwater streams; 2) esker-kame complexes spatially associated with ice-marginal positions and large areas of ice stagnation; 3) ice-marginal facies of subaquatic fans, marking the debouching position of subglacial drainage channels within proglacial water bodies; and 4) ice-contact deltas.

Deposits of ice-contact stratified drift are highly variable, consisting of a chaotic stratified mixture of boulder gravel to very fine-textured sand and silt. Lenses and/or beds of diamicton are occasionally observed within these deposits as well. Ice-contact deposits form an important element of the surficial deposits of the study area. The most notable deposits are situated in: 1) southeastern Cascaden and western Trill townships where a large re-entrant passing through Windy Lake formed along the retreating ice margin; 2) northwestern Wisner Township where a large esker-kame complex is situated; and 3) central



Figure 4. Photo of the boulder-strewn surface of the Cartier I Moraine, Levack Township.

MacLennan Township where a large subglacial drainage system extended southward out of the Wanapitei Lake basin. A number of smaller, isolated deposits associated with the Cartier I Moraine and other esker-kame complexes have also been identified within the study area. Ice-contact deltas grading to a high-level glacial lake (glacial Lake Algonquin) have been identified in: southeastern Trill Township adjacent to Fairbank Lake and in northwestern Hanmer Township; northwestern Capreol Township; east-central Capreol Township; and southern MacLennan Township along the trend of the Cartier I Moraine.

Terraced glaciofluvial outwash deposits occur within all of the major structurally-controlled river valleys which enter the Sudbury basin off the north and east ranges. The most notable of these include: the Vermilion River valley in Parkin and Norman townships; the Rapid River valley in Wisner Township; the Nelson River valley in Bowell and Lumsden townships; the Sandcherry Creek valley in Foy and Morgan townships; and the Onaping River valley in Levack and Dowling townships. As many as 5 or 6 distinct fluvial terraces have been identified in each of these valleys. The terraces formed in response to lowering base levels as the levels of glacial Lake Algonquin declined. Large glaciolacustrine deltas formed where these fluvial systems entered the lake. The most notable of these are located in west-central Capreol and northeastern Hanmer townships. These deltas relate to drainage off the headwaters of the Vermilion and Rapid rivers, in central Lumsden Township at the mouth of the Nelson River, in east-central Morgan Township at the mouth of Sandcherry Creek and in central Dowling Township at the mouth of the Onaping River.

Extensive deposits of glaciofluvial sand and gravel in southern MacLennan Township, associated with a re-entrant which formed along the ice margin at a structural zone of weakness, extend southward from Massey Bay out of the Wanapitei Lake basin. These deposits initially accumulated within a subglacial conduit and subsequently were laid down in an open, ice-walled channel which attained a maximum width of 6 km. Large ice-block depressions marking the former position of the subglacial conduit formed as a

result of collapse and burial of the thinning ice roof during the waning stages of glaciation. The flat-topped, glaciofluvial plain straddling these kettles, and on which the Sudbury airport is built, grades to a level of glacial Lake Algonquin and is therefore technically of deltaic origin.

The glaciofluvial deposits observed within the study area consist of well sorted and graded sands and gravels. Most of the deposits listed above are sand and fine gravel-dominated, however, significant high-energy, coarse gravel facies occur locally within the systems. Aggregate resource inventories covering the western half of the Regional Municipality of Sudbury (Ontario Geological Survey 1987) and the adjoining eastern half (Rowell 1999) provide information on the distribution, extractable volume, texture and quality of the aggregate deposits.

Massive to laminated deposits of pebbly sand to silt with minor clay associated with glacial Lake Algonquin are found exclusively within low-lying areas of the "valley". These glaciolacustrine deposits fine laterally away from the main sediment input sources along the north and east ranges and, in places, coarsen upward where they are spatially associated with prograding deltaic bodies. Sand-rich facies dominate the glaciolacustrine record within the study area forming broad, flat plains in Capreol and Hanmer townships and thick, valley-fills in Lumsden, Morgan and Dowling townships along the Vermilion and Onaping rivers. Sand-rich, subaquatic fan facies were observed in low-lying areas of southwestern Trill Township. Fine-textured sediments are restricted to the southeastern corners of Trill, Dowling and Lumsden townships and the southwestern corner of Hanmer Township. These areas are situated generally in protected settings distal to the main sediment sources.

Abandoned shoreline features are well developed along the northern edge of the basin where waves and currents could erode newly deposited till and glaciofluvial deposits. In bedrock-dominated areas, the shoreline record is poor and, where present, weakly developed. Shoreline features include beach bars and spits, wave-cut and built platforms and shore bluffs. Excellent examples of these features occur along the flanks of the Sudbury airport glaciofluvial system and the southern flank of the Cartier I Moraine. Several levels of glacial Lake Algonquin are recorded in the littoral features of the region.

Sand-rich glaciolacustrine facies reworked/modified by eolian processes have produced thin, irregular sheets of fine- to very fine-grained sand over large areas of Hanmer and Capreol townships. The sheet sands generally display a slightly rolling, low-relief surface expression which, in some cases contain small longitudinal, transverse and parabolic forms. More extensive eolian deposits occur in southwestern Capreol Township on the fringes of a large meltwater channel which extends southward from Moose Lake to the southwest corner of the township. Isolated dunes on the eastern side of this channel extend up to 15 m above the surrounding lake plain and consist of very well sorted fine- to very fine-grained sand exhibiting diffuse ripples and planar laminae. Thin deposits of loess or wind-blown silt frequently form a thin veneer over till and bedrock in the upland areas of the north and east ranges.

Remnant fluvial channels incised into glaciofluvial and glaciolacustrine deposits on the "valley" floor occur in southern Capreol and Hanmer townships. This anastomosing system of channels branching southward and southwestward from Greens Lake, which is situated just south of Capreol, was utilized immediately following the decline of lake levels below the valley floor and the southward retreat of the corresponding shoreline. Downcutting along the Vermilion River valley following the drainage of glacial Lake Algonquin resulted in the formation of several low terraces along which alluvial sands were transported and redeposited. The river is currently an active, mature fluvial system. It meanders westward, constantly eroding older glaciolacustrine and alluvial deposits, abandoning cut-off channels. The abandoned channels form oxbow lakes which, in time, become vegetated wetlands.

Extensive peatlands are situated within broad, poorly drained lowlands in the "valley". They occupy abandoned meltwater channels cut into unconsolidated drift and structurally and lithologically-controlled basins within bedrock terrain. Smaller peatlands are situated in restricted, bedrock basins and along water courses transecting the uplands of the north and east ranges.

Readers interested in a more comprehensive account of the Quaternary geology of the Regional Municipality of Sudbury are referred to a paper that is scheduled to appear in an atlas on the geology and



physical environments of the Sudbury region (Barnett and Bajc, in press) and to a fieldtrip guidebook prepared for the 1999 Annual Meeting of the Geological Association of Canada (Bajc and Barnett 1999).

## Methods

### SAMPLE COLLECTION

Approximately 450 humus, B-horizon soil and C-horizon till samples were collected regionally throughout the study area within areas accessible by roads, bush trails, hydro lines and lakes. A helicopter-assisted program was undertaken to obtain samples from less accessible areas and to fill in the regional sampling grid. The regional sampling grid contains a sample density of approximately 1 sample per 5 km<sup>2</sup>. The distribution of sample locations is, however, limited by access as well as the nature of the surficial deposits within various areas. Sampling density increases in areas of known mineralization to 2 or 3 times the regional average. High density, property-scale sampling was conducted: 1) in south-central Parkin Township in the vicinity of the Parkin offset dike; 2) in northeastern Levack Township in the vicinity of the Barnet showing and the Strathcona, Coleman and Longvack ore bodies; 3) in southwestern Cascaden Township around the Ministic Offset Dike; 4) in east-central Foy Township surrounding the Nickel Offset Mine; 5) in central Norman Township centred on the Whistle Mine; and 6) along the Capreol/MacLennan township line surrounding the Victor and Nickel Rim orebodies (Figure 2). Sample spacing within these areas ranged from 200 to 500 m depending upon access. Sample location and site description information is available in Appendix A.

Till samples were collected almost exclusively from upland regions where glaciofluvial and glaciolacustrine deposits are thin or absent and did not prevent easy access to the till using conventional surface sampling techniques. Few samples were collected from within the "valley" as stratified deposits, usually exceeding several 10s of metres, conceal much of the bedrock surface and overlying till. Till was, however, encountered in some roadcuts along the flanks of bedrock outcrops where the capping of stratified sediments is thin.

Approximately 500 ml of humus were collected from each sample site for geochemical analysis. Much of the study area has been affected by forest fire activity. The resulting humus is usually thin, rooty, discontinuous and contains moderate amounts of charcoal. Samples were screened in the field to remove as much of this root material and charcoal as possible. A sparse vegetation cover along much of the east range has resulted in the contamination of humus samples with wind-blown silt and very fine-textured sand. Care was taken to avoid the inclusion of this particulate mineral matter with the organic humus samples.

B-horizon samples, weighing 2 to 3 kg, were collected from each site for geochemical analysis. In most cases, the sampled B-horizon was developed in till but there were a few situations where the till was covered by a thin layer of eolian sand and/or silt or glaciofluvial/ glaciolacustrine deposits. This material was noted and sampled accordingly. For the remainder of this report, the B-horizon sample will be referred to as B-horizon till. Samples were collected from the most oxidized material immediately below the leached Ae horizon of the podzolic soil profile and screened in the field to remove pebbles and roots.

Most C-horizon till samples were collected from shallow (~1 m deep) hand-dug testpits, roadcuts, trench exposures and small borrow pits. Samples were collected from the till-bedrock interface or from as deep as possible in areas of thick till. Samples were screened in the field to isolate the +5 mm pebble fraction for lithologic determinations. At each sample site, 2 samples of C-horizon till were collected for analysis. An 8 to 10 kg sample was collected for heavy mineral concentrating and subsequent gold grain and geochemical determinations and a 2 to 3 kg sample was collected for fine-fraction (<63 µm) geochemistry.

Profile sampling was conducted at 17 geochemically anomalous sites to investigate the nature of mobilization and redistribution of Ni-Cu-PGEs and associated elements within the zone of weathering.

Stratigraphic sampling was undertaken on cleared vertical sections, which in most cases, extended to the bedrock surface. Sample intervals were dictated by the total thickness of till exposed as well as the depth and thickness of soil horizons and till facies present. Samples were generally collected at a vertical interval of 20 cm or less. Two to 3 kg samples were collected from each stratigraphic horizon for fine fraction geochemistry. Samples were not collected for heavy mineral processing.

A pilot biogeochemical survey was conducted over Maclellan Township and eastern Capreol Township. Much of this area is within the zone of influence of the Falconbridge smelter. A number of past mineral producers are also present within this region. White birch leaves and twigs were collected from 18 trees in the early spring shortly after budding. The same trees were revisited and sampled in the Fall to document the temporal variation in geochemical response and possibly obtain information on the effects of atmospheric fallout within this area. Vegetation samples were collected at a slightly higher density in the immediate vicinity of the Victor and Nickel Rim ore bodies to determine the geochemical response in the immediate vicinity of mineralization.

## SAMPLE PREPARATION AND ANALYSIS

The -80 mesh (-177  $\mu\text{m}$ ) fraction of humus, the -230 mesh (-63  $\mu\text{m}$ ) fraction of B-horizon soils and C-horizon tills and the -63  $\mu\text{m}$  and -2  $\mu\text{m}$  fractions of profile samples were analyzed following both a "near total" aqua regia digestion and a phase selective leach. The -2 mm non-magnetic heavy mineral fraction of C-horizon tills were analyzed following an aqua regia digestion. The "near total" analyses yielded geochemical data for approximately 30 elements using the following packages: 1) a suite of trace and minor elements by aqua regia digestion and inductively coupled plasma emission spectrometry (ICP-ES) at Bondar-Clegg Laboratories (Vancouver, Canada); 2) the hydride elements (As, Sb, Bi, Se, Te and Ge) by aqua regia digestion, separation from potential interferences by coprecipitation with  $\text{La}(\text{OH})_3$  and analysis by hydride generation ICP-ES at Acme Analytical Laboratories Limited (Vancouver, Canada); and 3) Au, Pt and Pd by Pb fire assay at Bondar-Clegg Laboratories and inductively coupled plasma mass spectrometry (ICP-MS) analysis of the resulting Ag prill at the Geological Survey of Canada (GSC) (for details, see Hall and Pelchat 1994).

The selective extraction of the "soluble organic" phase of humus was undertaken using 0.1M sodium pyrophosphate at room temperature and the elements thereby dissolved (e.g., Zn, Cu, Ni, Co, Pb, Mn, Fe) determined by atomic absorption spectrometry (AAS) at the GSC (for details, see Hall et al. 1996a). The amorphous Fe oxyhydroxide phase of the B- and C-horizon samples was extracted using 0.25M hydroxylamine hydrochloride in 0.05 M HCl at room temperature after first removing elements bound as adsorbed, exchangeable or within carbonates using a sodium acetate leach (for details, see Hall et al. 1996b). This procedure, including analysis of the leachate by ICP-ES, was carried out by X-Ray Assay Laboratories Limited (Toronto, Canada). Method detection limits for both the partial and near total leaches of a selected suite of elements are presented in Tables 1 to 3.

Birch twigs and leaves were ashed (450  $^{\circ}\text{C}$ ) at the GSC prior to geochemical analysis for over 35 elements by instrumental neutron activation analysis (INAA) at Activation Laboratories Limited (Ancaster, Canada). A suite of approximately 30 trace and minor elements were obtained from a split of the same ashed samples following a standard aqua regia digestion and ICP-ES finish at Acme Analytical Laboratories Limited (Vancouver, Canada). The precious metals (Au, Pt and Pd) were determined by fire assay preconcentration of the ashed samples and analysis by ICP-ES and Graphite Furnace AAS at Acme Analytical Laboratories Limited (Vancouver, Canada).

Heavy minerals were separated from the -2 mm fraction of C-horizon tills by wet gravity tabling, producing a "table concentrate", and then further concentrated to >3.3 S.G. using density dependent settling in methylene iodide. Magnetic minerals were removed from the methylene iodide HMC using an automagnet. The weights of the resulting fractions were recorded. At the tabling stage, a preliminary count of gold grains, including size and shape determinations was undertaken. The gold grain content of the table concentrates was further refined using a secondary panning procedure to obtain more exact grain

counts. The size and shape of the panned gold grains were recorded before they were returned to the table concentrate.

## QUALITY CONTROL

### Precision

Blind pulp duplicates were inserted, at a frequency of 1 in 20, into the sample sequences as a measure of analytical precision. Thompson and Howarth (1978) log-log plots were used to estimate precision based on replicate analyses of approximately 20 duplicates for each medium analyzed. Precision levels are shown in Tables 1 to 3 for a selected number of elements. Precision is quoted at the 95% confidence level and is expressed as a percentage (twice the RSD). Precision values are not reported for elements whose levels frequently drop below detection limit. Precision levels for lab or pulp duplicates provide an indication of the variance of the field data that is a function of analytical error. Field duplicates were not collected as part of this survey and therefore, no information is available on the geochemical variability at the sampling site.

### Accuracy

Both certified and "in-house" reference standards were inserted in the sample sequence with a frequency of 1 in 20 to monitor data accuracy. Summary statistics for a selected number of elements in the various standards are presented in Tables 1 to 3.

## DATA TREATMENT AND PRESENTATION

Geochemical values reported as less than detection limit were reassigned values of one-half the reported detection limit for the calculation of summary statistics. Variables that displayed positively skewed populations were log-transformed prior to the subsequent calculation of correlation coefficients. Univariate and multivariate statistics were calculated using the DOS-based computer program Statgraphics Plus for Windows (Version 3.0).

The spatial distribution of analytical data are plotted as proportionally-sized dots on a geographic base that also shows bedrock geology. Depending upon the parameter being depicted, the dot diameter is proportional to its respective concentration. In the case of geochemistry, the cutoff values assigned to the various dot sizes usually correspond to the 95<sup>th</sup>, 90<sup>th</sup>, 75<sup>th</sup> and 50<sup>th</sup> percentiles of the datasets.

To reduce cumbersome text describing which sample medium and digestion has been utilized for a particular geochemical response, the authors have chosen to use a number in parentheses following the element in question. For example, the number "1" in parentheses following the element "Ni" refers to the nickel response in humus following a standard, near-total, aqua regia digestion. The complete abbreviation guide is listed below.

- (1) humus, near-total (aqua regia) digestion
- (2) humus, partial (sodium pyrophosphate) digestion
- (3) B-horizon till, near-total (aqua regia) digestion
- (4) B-horizon till, partial (hydroxylamine hydrochloride) digestion
- (5) C-horizon till, near-total (aqua regia) digestion
- (6) C-horizon till, partial (hydroxylamine hydrochloride) digestion
- (7) Non-magnetic HMC fraction of C-horizon till, near total (aqua regia) digestion



Table 1. Elements, analytical methods, method detection limits and data quality information obtained from humus geochemical datasets.

| Element                              | Method    | MDL<br>ppm* | Duplicate Data |           | Int. Std.1 |              | Int. Std.2 |    | Int. Std.3   |            | LKSD-4 |              | TDB-1      |      | UMI-1      |              |            |       |       |     |       |       |      |
|--------------------------------------|-----------|-------------|----------------|-----------|------------|--------------|------------|----|--------------|------------|--------|--------------|------------|------|------------|--------------|------------|-------|-------|-----|-------|-------|------|
|                                      |           |             | N              | Prec<br>% | N          | Mean<br>ppm* | SD<br>ppm* | N  | Mean<br>ppm* | SD<br>ppm* | N      | Mean<br>ppm* | SD<br>ppm* | N    | Ref<br>ppb | Mean<br>ppm* | SD<br>ppm* |       |       |     |       |       |      |
| Partial Leach (Sodium Pyrophosphate) |           |             |                |           |            |              |            |    |              |            |        |              |            |      |            |              |            |       |       |     |       |       |      |
| Cu                                   | AAS       | 2.0         | 20             | 10        | 11         | 6.2          | 2.0        | 10 | 3.6          | 0.7        | -      | -            | 10         | 7.6  | 0.5        | -            | -          | -     |       |     |       |       |      |
| Pb                                   | AAS       | 5.0         | 20             | 10        | 11         | 11.3         | 1.6        | 10 | 1.1          | 1.6        | -      | -            | 10         | 54.6 | 3.1        | -            | -          | -     |       |     |       |       |      |
| Ni                                   | AAS       | 2.0         | 20             | 15        | 11         | 6.5          | 4.0        | 10 | 3.0          | 1.9        | -      | -            | 10         | 6.9  | 1.4        | -            | -          | -     |       |     |       |       |      |
| Co                                   | AAS       | 2.0         | 20             | 50        | 11         | 2.0          | 1.4        | 10 | 1.9          | 1.3        | -      | -            | 10         | 1.8  | 1.1        | -            | -          | -     |       |     |       |       |      |
| Near Total Leach (Aqua Regia)        |           |             |                |           |            |              |            |    |              |            |        |              |            |      |            |              |            |       |       |     |       |       |      |
| Cr                                   | ICP-ES    | 1.0         | 21             | 10        | 11         | 36.3         | 1.2        | 10 | 24.0         | 1.2        | -      | -            | -          | -    | -          | -            | -          | -     |       |     |       |       |      |
| Co                                   | ICP-ES    | 1.0         | 21             | 15        | 11         | 6.7          | 0.5        | 10 | 6.4          | 0.8        | -      | -            | -          | -    | -          | -            | -          | -     |       |     |       |       |      |
| Ni                                   | ICP-ES    | 1.0         | 21             | 20        | 11         | 52.3         | 4.9        | 10 | 17.1         | 2.0        | -      | -            | -          | -    | -          | -            | -          | -     |       |     |       |       |      |
| Cu                                   | ICP-ES    | 1.0         | 21             | 15        | 11         | 34.8         | 1.7        | 10 | 18.4         | 1.7        | -      | -            | -          | -    | -          | -            | -          | -     |       |     |       |       |      |
| Ag                                   | ICP-ES    | 0.2         | 21             | 50        | 11         | ND           | ND         | 10 | ND           | ND         | -      | -            | -          | -    | -          | -            | -          | -     |       |     |       |       |      |
| Pb                                   | ICP-ES    | 2.0         | 21             | 20        | 11         | 25.4         | 4.0        | 10 | 12.8         | 1.3        | -      | -            | -          | -    | -          | -            | -          | -     |       |     |       |       |      |
| Pd                                   | FA/ICP-MS | 0.5         | 21             | 30        | 6          | 1.0          | 0.3        | 6  | 0.8          | 0.6        | 3      | 1.2          | 0.3        | -    | -          | 22.4         | 23.0       | 106.0 | 117.4 | 4.2 |       |       |      |
| Pt                                   | FA/ICP-MS | 0.1         | 21             | 60        | 6          | 0.4          | 0.2        | 6  | 0.5          | 0.1        | 3      | 1.1          | 0.2        | -    | -          | 3            | 5.8        | 4.9   | 0.2   | 6   | 129.0 | 129.5 | 12.8 |
| Au                                   | FA/ICP-MS | 1.0         | 21             | 60        | 6          | 2.6          | 0.7        | 6  | 3.9          | 6.4        | 3      | 2.0          | 0.7        | -    | -          | 3            | 6.3        | 4.9   | 1.4   | 6   | 48.0  | 51.6  | 3.9  |
| As                                   | HG/ICP-ES | 0.1         | 20             | 35        | 5          | 1.9          | 1.1        | 6  | 11.2         | 2.6        | 3      | 7.1          | 0.9        | -    | -          | 3            | -          | 1.9   | 0.6   | 3   | -     | 1.3   | 0.1  |
| Sb                                   | HG/ICP-ES | 0.1         | 20             | 60        | 5          | 0.3          | 0.1        | 6  | 0.2          | 0.2        | 3      | 2.9          | 0.3        | -    | -          | 3            | -          | 0.6   | 0.1   | 3   | -     | 0.2   | 0.1  |
| Bi                                   | HG/ICP-ES | 0.1         | 20             | 45        | 5          | 1.3          | 0.7        | 6  | 1.0          | 0.6        | 3      | 0.3          | 0.1        | -    | -          | 3            | -          | 0.2   | 0.1   | 3   | -     | 0.4   | 0.1  |
| Se                                   | HG/ICP-ES | 0.1         | 20             | 45        | 5          | 0.3          | 0.3        | 6  | 0.5          | 0.2        | 3      | 6.2          | 0.6        | -    | -          | 3            | -          | 0.3   | 0.1   | 3   | -     | 5.0   | 0.7  |
| Te                                   | HG/ICP-ES | 0.1         | 20             | 95        | 5          | 0.2          | 0.2        | 6  | 0.2          | 0.2        | 3      | ND           | ND         | -    | -          | 3            | -          | -     | ND    | 3   | -     | 0.3   | 0.2  |

Notes:

MDL: Method detection limit

ppm\*: all values in ppm except Pb, Pd and Au which are reported in ppb

N: number of duplicates or standards

Prec: precision derived from Thompson and Howarth precision control charts (95% confidence)

SD: standard deviation

Ref: reported value for Canmet Certified Reference standard

Table 2. Elements, analytical methods, method detection limits and data quality information obtained from B- and C-horizon till geochemical datasets.

| Element                                     | Method    | MDL<br>ppm* | Duplicate<br>Data |           | Int. Std.1 |              |            | Int. Std.2 |              |            | Int Std 3 |              |            | TDB-I |            |              | UMT-I      |    |            | WGB-I        |            |    |      |      |     |
|---------------------------------------------|-----------|-------------|-------------------|-----------|------------|--------------|------------|------------|--------------|------------|-----------|--------------|------------|-------|------------|--------------|------------|----|------------|--------------|------------|----|------|------|-----|
|                                             |           |             | N                 | Prec<br>% | N          | Mean<br>ppm* | SD<br>ppm* | N          | Mean<br>ppm* | SD<br>ppm* | N         | Mean<br>ppm* | SD<br>ppm* | N     | Ref<br>ppb | Mean<br>ppm* | SD<br>ppm* | N  | Ref<br>ppb | Mean<br>ppm* | SD<br>ppm* |    |      |      |     |
| Partial Leach (Hydroxylamine Hydrochloride) |           |             |                   |           |            |              |            |            |              |            |           |              |            |       |            |              |            |    |            |              |            |    |      |      |     |
| Cr                                          | ICP-ES    | 1.0         | 45                | 20        | 25         | 23.8         | 6.5        | 22         | 7.2          | 1.0        | -         | -            | -          | -     | -          | -            | -          | -  | -          | -            | -          |    |      |      |     |
| Co                                          | ICP-ES    | 1.0         | 45                | 20        | 25         | 10.1         | 2.2        | 22         | ND           | ND         | -         | -            | -          | -     | -          | -            | -          | -  | -          | -            | -          |    |      |      |     |
| Ni                                          | ICP-ES    | 1.0         | 45                | 25        | 25         | 14.7         | 4.1        | 22         | 2.0          | 0.6        | -         | -            | -          | -     | -          | -            | -          | -  | -          | -            | -          |    |      |      |     |
| Cu                                          | ICP-ES    | 0.5         | 45                | 15        | 25         | 15.1         | 3.8        | 22         | ND           | ND         | -         | -            | -          | -     | -          | -            | -          | -  | -          | -            | -          |    |      |      |     |
| Ag                                          | ICP-ES    | 0.1         | 45                | ND        | 25         | ND           | ND         | 22         | ND           | ND         | -         | -            | -          | -     | -          | -            | -          | -  | -          | -            | -          |    |      |      |     |
| Pb                                          | ICP-ES    | 2.0         | 45                | 20        | 25         | 9.0          | 1.9        | 22         | ND           | ND         | -         | -            | -          | -     | -          | -            | -          | -  | -          | -            | -          |    |      |      |     |
| Near Total Leach (Aqua Regia)               |           |             |                   |           |            |              |            |            |              |            |           |              |            |       |            |              |            |    |            |              |            |    |      |      |     |
| Cr                                          | ICP-ES    | 1.0         | 47                | 10        | 25         | 98.8         | 9.0        | 22         | 26.0         | 3.4        | -         | -            | -          | -     | -          | -            | -          | -  | -          | -            | -          |    |      |      |     |
| Co                                          | ICP-ES    | 1.0         | 47                | 10        | 25         | 27.2         | 1.6        | 22         | 5.7          | 0.5        | -         | -            | -          | -     | -          | -            | -          | -  | -          | -            | -          |    |      |      |     |
| Ni                                          | ICP-ES    | 1.0         | 47                | 10        | 25         | 59.8         | 3.9        | 22         | 15.6         | 1.4        | -         | -            | -          | -     | -          | -            | -          | -  | -          | -            | -          |    |      |      |     |
| Cu                                          | ICP-ES    | 1.0         | 47                | 10        | 25         | 39.5         | 3.0        | 22         | 2.5          | 0.7        | -         | -            | -          | -     | -          | -            | -          | -  | -          | -            | -          |    |      |      |     |
| Ag                                          | ICP-ES    | 0.2         | 47                | 70        | 25         | 0.4          | 0.2        | 22         | 0.2          | 0.1        | -         | -            | -          | -     | -          | -            | -          | -  | -          | -            | -          |    |      |      |     |
| Pb                                          | ICP-ES    | 2.0         | 47                | 30        | 25         | 24.0         | 9.2        | 22         | 9.1          | 5.4        | -         | -            | -          | -     | -          | -            | -          | -  | -          | -            | -          |    |      |      |     |
| Pd                                          | FA/ICP-MS | 0.5         | 46                | 90        | 11         | 0.5          | 0.5        | 11         | ND           | ND         | 14        | 1.5          | 0.4        | 26    | 22.4       | 23.6         | 2          | 17 | 106.0      | 98.7         | 18         | 10 | 13.9 | 12.9 | 2.9 |
| Pt                                          | FA/ICP-MS | 0.1         | 46                | 60        | 11         | 0.4          | 0.1        | 11         | 0.2          | 0.0        | 14        | 1.2          | 0.2        | 26    | 5.8        | 5            | 0.5        | 17 | 129.0      | 119.4        | 23         | 10 | 6.1  | 6.4  | 4.8 |
| Au                                          | FA/ICP-MS | 1.0         | 46                | 120       | 11         | 1.5          | 0.9        | 11         | 0.2          | 0.3        | 14        | 3.7          | 3.7        | 26    | 6.3        | 5.9          | 1.1        | 17 | 48.0       | 44.6         | 8          | 10 | 2.9  | 3.8  | 4.8 |
| As                                          | HG/ICP-ES | 0.1         | 45                | 35        | 12         | 5.5          | 0.3        | 11         | 1.0          | 0.3        | 12        | 7.2          | 0.5        | 20    | -          | 1.9          | 0.5        | 18 | -          | 0.9          | 0          | 10 | -    | 1.6  | 0.6 |
| Sb                                          | HG/ICP-ES | 0.1         | 45                | 100       | 12         | 0.3          | 0.1        | 11         | ND           | ND         | 12        | 2.5          | 0.3        | 20    | -          | 0.5          | 0.1        | 18 | -          | ND           | ND         | 10 | -    | 0.9  | 0.2 |
| Bi                                          | HG/ICP-ES | 0.1         | 45                | 110       | 12         | 0.6          | 0.1        | 11         | 0.2          | 0.1        | 12        | 0.2          | 0.1        | 20    | -          | 0.2          | 0.1        | 18 | -          | 0.2          | 0          | 10 | -    | ND   | ND  |
| Se                                          | HG/ICP-ES | 0.1         | 45                | 100       | 12         | ND           | ND         | 11         | ND           | ND         | 12        | 6.0          | 0.7        | 20    | -          | ND           | ND         | 18 | -          | 4.4          | 1          | 10 | -    | ND   | ND  |
| Te                                          | HG/ICP-ES | 0.1         | 45                | 75        | 12         | ND           | ND         | 11         | ND           | ND         | 12        | ND           | ND         | 20    | -          | ND           | ND         | 18 | -          | 0.4          | 0          | 10 | -    | ND   | ND  |

Notes:

MDL: Method detection limit

ppm\*: all values in ppm except Pt, Pd and Au which are reported in ppb

N: number of duplicates or standards

Prec: precision derived from Thompson and Howarth precision control charts (95% confidence)

SD: standard deviation

Ref: reported value for Canmet Certified Reference standard

**Table 3.** Elements, analytical methods, method detection limits and data quality information obtained from the non-magnetic HMC fraction of C-horizon till geochemical datasets.

| Element | Method | MDL<br>ppm* | Duplicate Data |        | TDB-1 |            |              |            | UMT-1 |            |              |            |
|---------|--------|-------------|----------------|--------|-------|------------|--------------|------------|-------|------------|--------------|------------|
|         |        |             | N<br>ppm*      | Prec % | N     | Ref<br>ppb | Mean<br>ppm* | SD<br>ppm* | N     | Ref<br>ppb | Mean<br>ppm* | SD<br>ppm* |

Near Total Leach (Aqua Regia)

|    |           |     |    |     |    |      |       |      |    |       |        |      |
|----|-----------|-----|----|-----|----|------|-------|------|----|-------|--------|------|
| Cr | ICP-ES    | 1.0 | 18 | 15  | 8  | -    | 43.5  | 3.2  | 11 | -     | 255    | 18.8 |
| Co | ICP-ES    | 1.0 | 18 | 10  | 8  | -    | 19    | 1.1  | 11 | -     | 39     | 1.6  |
| Ni | ICP-ES    | 1.0 | 18 | 10  | 8  | -    | 30.4  | 1.9  | 11 | -     | 1085.5 | 48.9 |
| Cu | ICP-ES    | 1.0 | 18 | 25  | 8  | -    | 324.3 | 21.7 | 11 | -     | 724.6  | 37.4 |
| Ag | ICP-ES    | 0.2 | 18 | 70  | 8  | -    | ND    | ND   | 11 | -     | 0.8    | 0.1  |
| Pb | ICP-ES    | 2.0 | 18 | 30  | 8  | -    | 17.4  | 3.1  | 11 | -     | ND     | ND   |
| As | HG/ICP-ES | 0.1 | 17 | 60  | 10 | -    | 1.6   | 0.6  | 10 | -     | 0.7    | 0.5  |
| Sb | HG/ICP-ES | 0.1 | 17 | 50  | 10 | -    | 0.7   | 0.1  | 10 | -     | ND     | ND   |
| Bi | HG/ICP-ES | 0.1 | 17 | 120 | 10 | -    | ND    | ND   | 10 | -     | ND     | ND   |
| Se | HG/ICP-ES | 0.1 | 17 | 60  | 10 | -    | 0.2   | 0.2  | 10 | -     | 2.2    | 0.3  |
| Te | HG/ICP-ES | 0.1 | 17 | 90  | 10 | -    | ND    | ND   | 10 | -     | ND     | ND   |
| Au | FA/ICP-MS | 1.0 | 17 | 130 | 10 | 6.3  | 8.3   | 7.2  | 10 | 48.0  | 46.2   | 14.5 |
| Pt | FA/ICP-MS | 1.0 | 17 | 120 | 10 | 5.8  | 5.9   | 2.7  | 10 | 129.0 | 104.2  | 42.8 |
| Pd | FA/ICP-MS | 1.0 | 17 | 120 | 10 | 22.4 | 24.6  | 8.6  | 10 | 106.0 | 84.0   | 32.0 |

**Notes:**

MDL: Method detection limit

ppm\*: all values in ppm except Pt, Pd and Au which are reported in ppb

N: number of duplicates or standards

Prec: precision derived from Thompson and Howarth precision control charts (95% confidence)

SD: standard deviation

Ref: reported value for Canmet Certified Reference standard

Appendices A through N contain: 1) sample location and site description information; 2) heavy mineral weight data for C-horizon till; 3) detailed particulate gold grain data including grain size and shape information; 4) regional geochemical plots for the  $-177\mu\text{m}$  fraction of humus (aqua regia and sodium pyrophosphate digestions), the  $-63\mu\text{m}$  fraction of B- and C-horizon till (aqua regia and hydroxylamine hydrochloride digestions) and the  $-2\text{ mm}$  non-magnetic HMC fraction of C-horizon till (aqua regia digestion); and 5) summary statistics, frequency histograms, cumulative probability plots and Pearson moment correlation matrices for the 7 geochemical datasets.

## Controls on Surface Geochemistry

Prior to the evaluation of the regional geochemical datasets, it was deemed essential to establish whether distinct geochemical populations could be identified which reflect variations in local parameters such as underlying bedrock type, local vegetation, aspect and drainage of the sampling site and facies of till collected. In the event that such a relationship was identified, it would be important to subdivide the geochemical datasets into subpopulations and determine threshold anomalies for each subpopulation individually. The parameter that was considered to be of greatest importance was the underlying bedrock type which intuitively should have a direct relationship to the concentration of elements in not only C-horizon till but the soils developed on them (i.e., A- and B-horizons). The facies of till collected was investigated to determine whether distinct background concentrations of metals could be associated with different till types. The local vegetation at the sampling site was also examined to determine whether different forest types partitioned metals differently and therefore resulted in distinct background geochemical signatures for the resulting humus. Factors such as slope and drainage are directly linked to soil-forming processes and have been evaluated in terms of their affect on A- and B-horizon geochemistry.

### BEDROCK DOMAIN

Fourteen distinct bedrock domains occur within the study area. Plots displaying the ranges of Ni and Cu in humus, B-horizon till and C-horizon till for both the standard aqua regia and selective leaches are presented in Figures 5 and 6, respectively. A number of generalizations can be made with regard to the absolute concentrations of Ni and Cu within the various sample media. Ni and Cu occur at far higher concentrations in humus than in B- and C-horizon soils. This is likely a reflection of the ability of the humic and fulvic acids present within the humus to scavenge metals and effectively bind them. Anthropogenic or airborne sources of metals may also be, in part, responsible for the elevated levels within the humus. The absolute concentrations of Cu in B-horizon till is lower than in the C-horizon. This is attributed to its dissolution and hydromorphic dispersion under the acidic soil conditions which occur within the zone of weathering. The Ni datasets for B- and C-horizon tills show similar ranges and therefore appear to be less affected by hydromorphic processes.

Only slight variations in the ranges of Ni and Cu in humus over the various bedrock domains were observed. A few of the bedrock domains, however, are "under-represented" with respect to total numbers of samples and, as a result, show slightly narrower ranges in elemental concentrations. As well, no bedrock domain stands out as yielding exceptionally higher values. For this reason, we feel confident in treating the humus datasets as single populations with 1 set of threshold limits.

The B- and C-horizon data show slightly different trends. The upper limits of the ranges of Ni and Cu in B-horizon samples collected over norites (SIC) and Levack gneiss are consistently higher than those obtained from samples collected over other bedrock domains. The C-horizon till data also show elevated upper limits of Ni and Cu in samples collected over quartz diorite (SIC) and mafic extrusive rocks. These rock types are favourable host lithologies for Ni-Cu-PGE mineralization. Since their lower limits are similar to those obtained from other bedrock domains, it would appear that their anomalous populations are simply those values above the normal range for all bedrock domains. Therefore, it would not appear to be warranted to treat these datasets as separate populations for the determination of threshold limits. As a test, the C-horizon till, aqua regia dataset for Ni and Cu were subdivided into 5 subpopulations based on



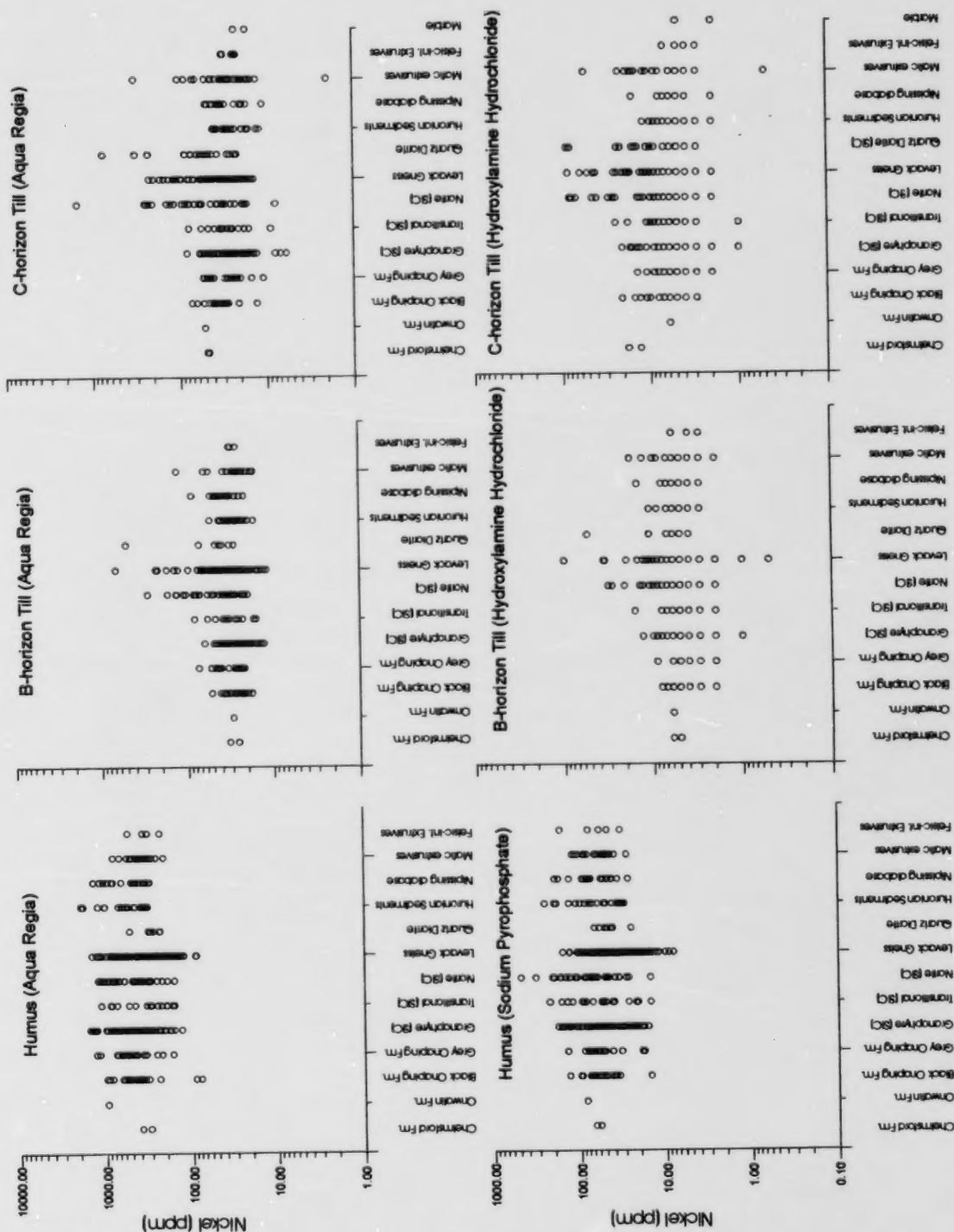


Figure 5. Ranges of nickel in humus, B- and C-horizon till over various bedrock domains.



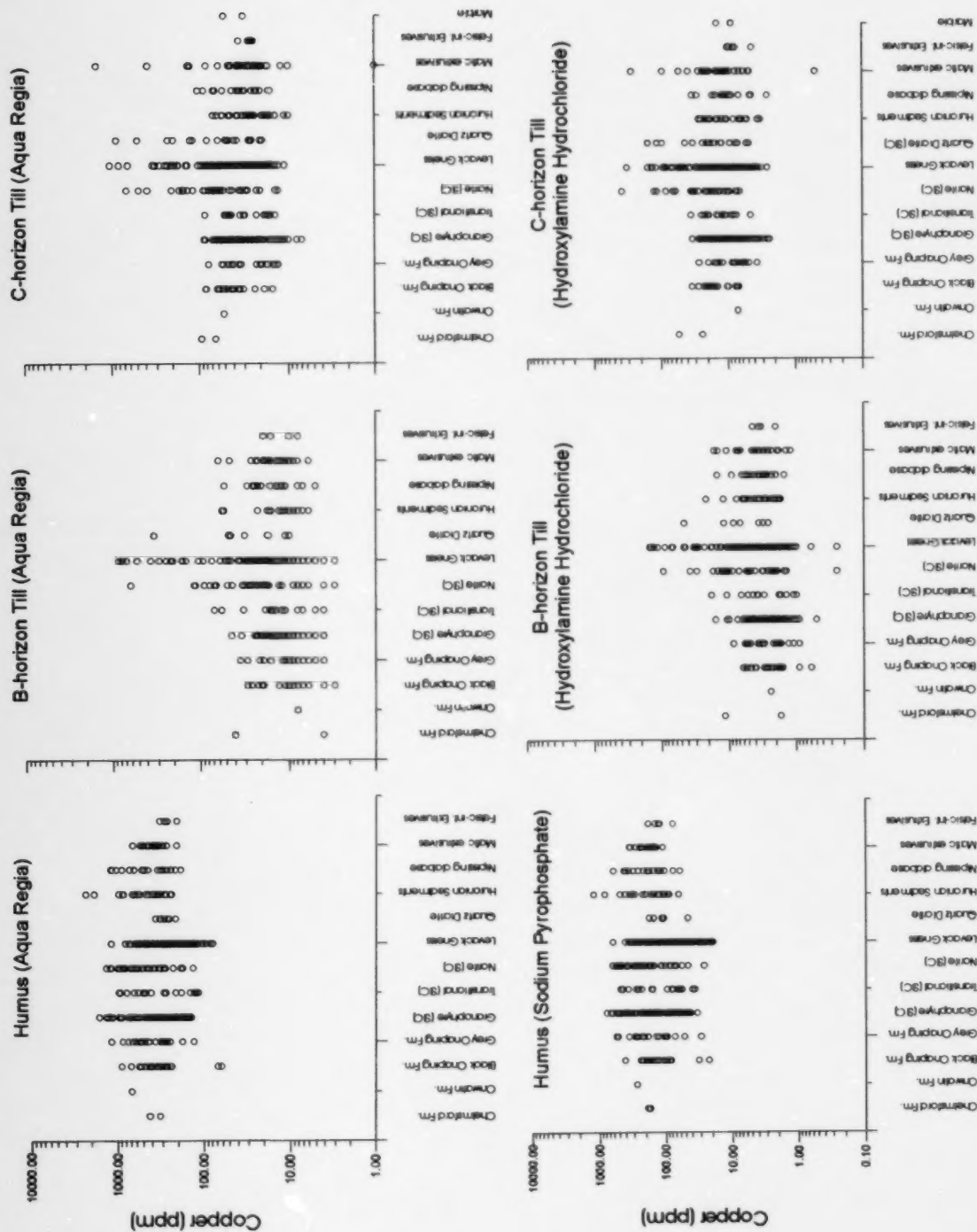


Figure 6. Ranges of copper in humus, B- and C-horizon till over various bedrock domains.

underlying bedrock type, threshold anomalies were assigned to each subpopulation and anomaly maps were constructed. The patterns depicted by these plots were essentially the same as those generated by treating the dataset as a single population.

## FOREST TYPE

Figure 7 presents the ranges of Ni and Cu in humus for samples collected over 4 forest types. Deciduous and mixed forests appear to yield slightly higher upper limits of both sodium pyrophosphate and aqua regia-extracted Ni and Cu but similar lower limits. Similar conclusions were drawn from an evaluation of the Pt, Pd and Au datasets. It is unclear whether this difference is a function of the enhanced ability of deciduous vegetation to take up elements from the substrate within which the root systems penetrate. Deciduous trees generally have deeper root systems than conifers. Their root systems may therefore tap into either locally-derived glacial debris at depth, fractures in the bedrock surface or groundwaters flowing along the bedrock/overburden interface, all of which may contain elevated metal levels. The data presented does not appear to warrant a re-evaluation of the datasets using subpopulations based on vegetation type.

## TILL FACIES

Three distinct facies of till have been observed within the study area. Figures 8 and 9 show the ranges of Ni and Cu in humus, B- and C-horizon soils developed on these till facies for both the standard aqua regia and the selective extractions. The humus datasets do not appear to be affected by the till facies over which they are developed (i.e., the ranges of Ni and Cu are remarkably similar for all 3 populations). The B- and C-horizon till data do, however, display distinct upper limits to their ranges. The lodgement facies populations contain a significant number of samples with values of Ni and Cu greater than those of meltout and flow, and supraglacial till facies. This observation is not unexpected in that debris deposited as flows at the ice margin or as supraglacial hummocks on top of the glacier can be derived from both local and distal sources. In this study, distal lithologies typically yield low levels of Ni and Cu. Lodgement till more closely reflects the composition of the bedrock at the sampling site. For this reason, lodgement tills collected over favourable host lithologies such as norite contain elevated values of Ni and Cu. Since the lower limits for the ranges of B- and C-horizon till are all fairly consistent, it does not appear to be necessary to subdivide the geochemical datasets into subpopulations based on till facies.

## ASPECT AND DRAINAGE

Aspect and drainage were similarly evaluated to determine their role in the formation of geochemical anomalies. The aspect of each sampling site was classified under the following headings: up ice; down ice; crest; valley bottom; and flat. The range of values observed for C-horizon till within each of these subpopulations is similar for both the Ni and Cu datasets. The drainage of each sampling site was also classified as either well, moderate or poor. Most samples were collected from well and, to a lesser extent, moderately drained settings. These populations displayed similar ranges of Ni and Cu for both the humus and soil geochemical datasets. It would appear that aspect and drainage do not play a significant role in the formation of geochemical anomalies. These factors need not be considered as significant factors in the evaluation of geochemical response.

## SOIL-FORMING PROCESSES

Profile sampling was undertaken at several geochemically anomalous sites to examine the vertical variation in Ni, Cu and the precious metals (Pt-Pd-Au). Post-depositional, low-temperature geochemical processes that occur as a result of weathering in an oxidizing surficial environment tend to alter and distort the chemistry of mineral phases that were originally sorted into various grain size fractions on the basis of their resistance to abrasion. The purpose of this sampling exercise was to better understand the extent to which

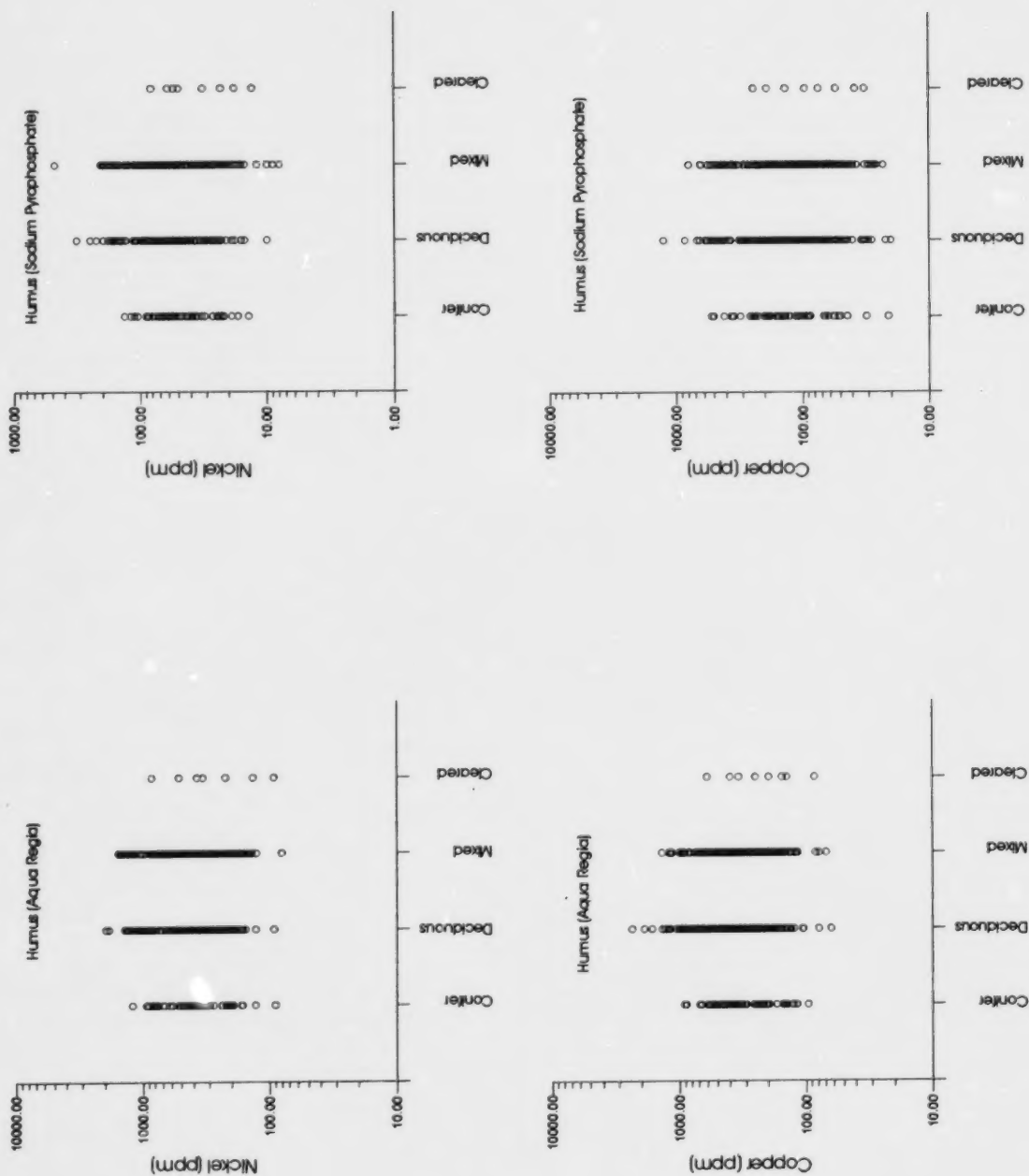


Figure 7. Ranges of nickel and copper in humus over various forest types.

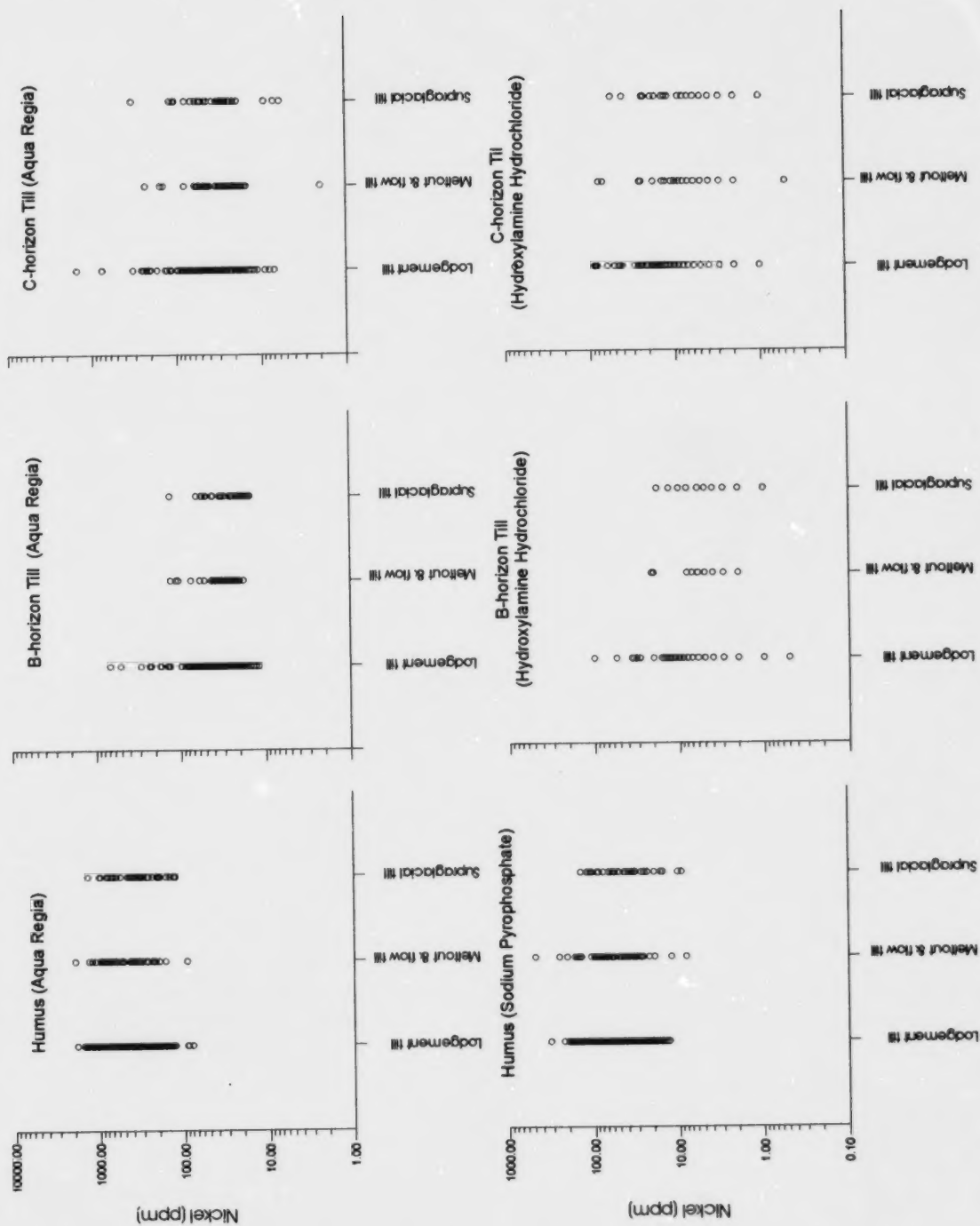


Figure 8. Ranges of nickel in humus, B- and C-horizon till over various till facies.

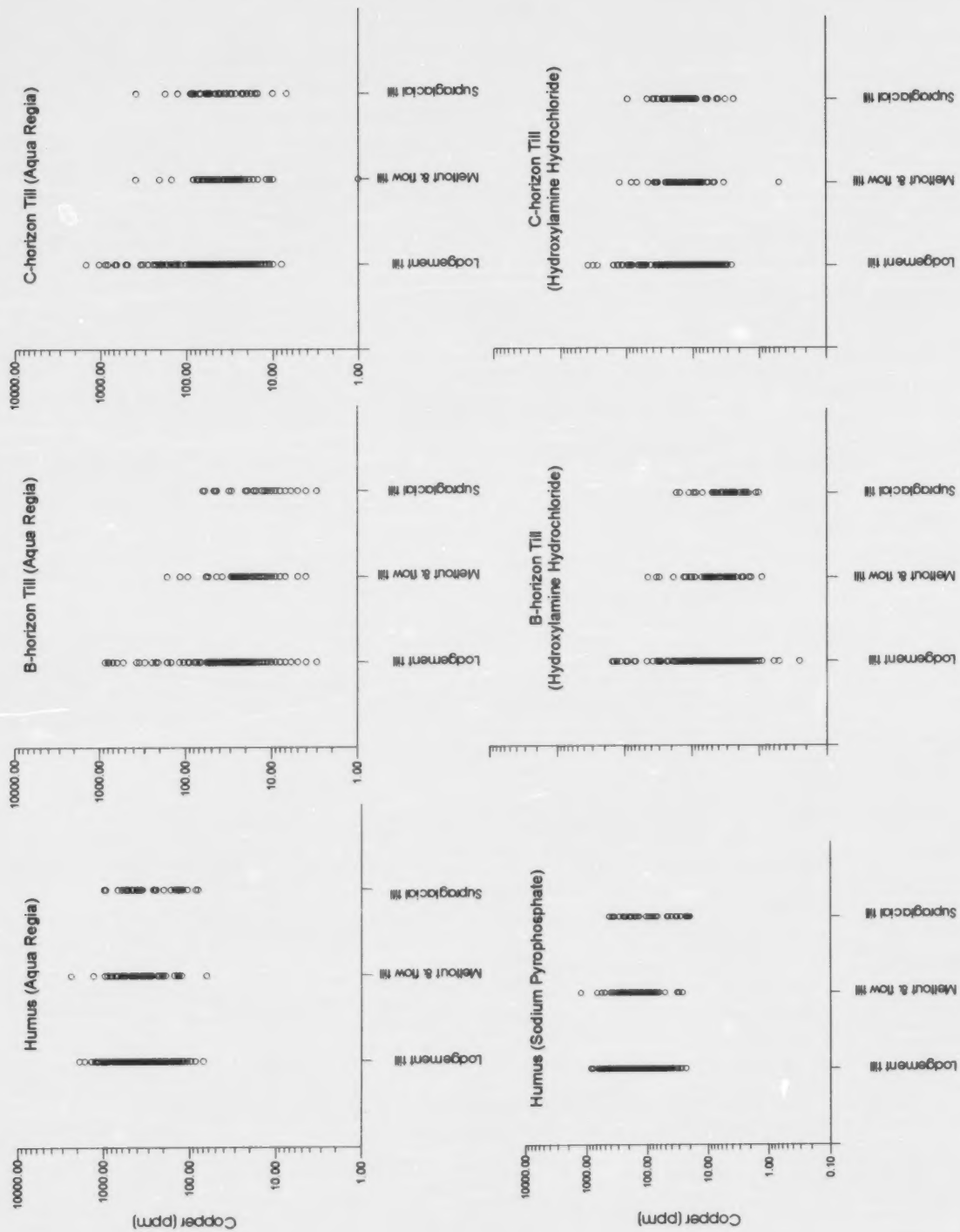


Figure 9. Ranges of copper in humus, B- and C-horizon till over various till facies.



these surficial processes have affected the geochemical signature of soils present in the Sudbury region with a focus on establishing which horizon is best suited for programs of surficial geochemistry.

In an oxidizing environment, labile minerals such as sulphides and carbonates are generally destroyed. Their chemical constituents are often either carried away in solution and precipitated or scavenged locally by clay-sized phyllosilicates and by secondary oxides/hydroxides depending upon the element and the local geochemical environment. In porous and permeable glacial sediments, additional weathering of primary silicate mineral phases that are unstable in the near surface environment produces a fine debris of secondary mixed-layer clays, hydroxides, oxides, etc. which can be physically translocated by percolating groundwater from the surface downward through the deposit. The enhanced scavenging ability of these secondary products can result in elevated concentrations of cations at their final resting place. The effects of most importance to mineral exploration in the Sudbury region are the destruction of these primary labile mineral phases such as chalcopyrite, pentlandite and sperrylite (Pt arsenide) and the redistribution of their cations into secondary mineral phases or groundwater. The effects of surface weathering are less important in exploration geochemistry programs for more resistant ore-forming minerals such as gold, chromite and cassiterite.

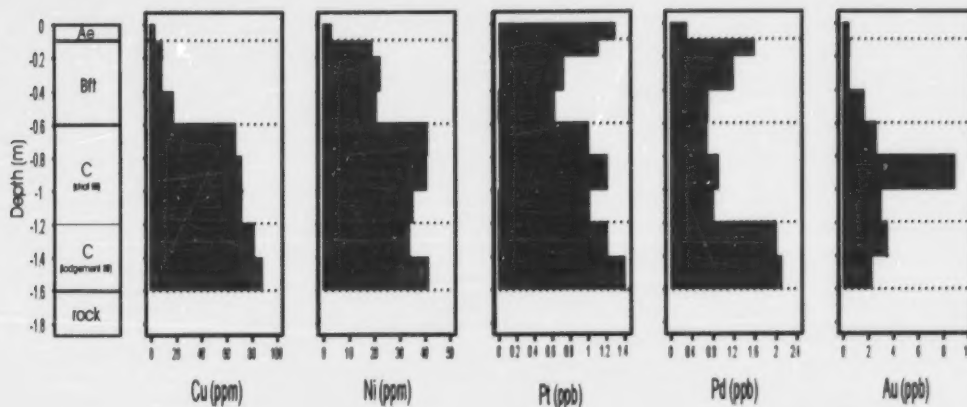
Mineralogical samples were collected vertically at intervals ranging from 0.1 to 0.2 m. The B- and C-horizons and, where present, the Ae-horizon were sampled at each site. The  $-63\mu\text{m}$  fraction (silt and clay) was analyzed following both a standard aqua regia and hydroxylamine hydrochloride leach and the  $-2\mu\text{m}$  fraction (clay) was analysed following a standard aqua regia digestion. Figures 10a-g present the results of the geochemical profiling.

A number of general statements can be made with respect to the profile information presented.

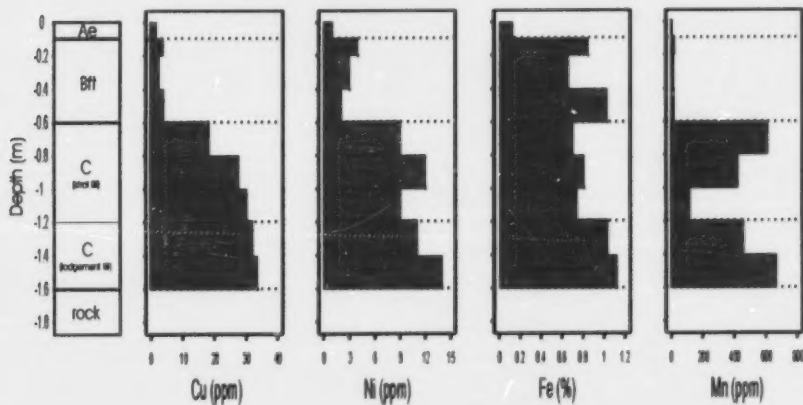
1. The Ae-horizon, where sampled, is usually depleted in the elements presented with respect to the underlying B-horizon. This is attributed to the hydromorphic dissolution of metals from this horizon by humic and fulvic acids originating from the overlying, organic, Ah-horizon. There are, however, exceptions to this general trend. At site 93-AFB-137, the clay fraction of the Ae-horizon is enriched in Cu, Ni and Mn. At site 93-AFB-132, the silt and clay fraction of the Ae-horizon is enriched in Pt.
2. The B-horizon is usually depleted in the elements presented with respect to the C-horizon. This is attributed to the destruction of labile minerals such as chalcopyrite and pentlandite by oxidation and the hydromorphic dispersion of their contained metals within the profile. There are, however, several instances where the B-horizon is enriched in Ni. There is usually a coincident increase in Fe in either the clay and/or silt and clay fraction of the B-horizon (e.g., site 93-AFB-134). The Fe probably occurs as either goethite or limonite and represents the weathered end-product of sulphide minerals oxidized by surface weathering. Goethite and limonite have a high cation exchange capacity and are excellent scavengers of soluble metals. Nickel and Fe have a similar atomic number and weight and therefore easily exchange for each other in solid solution series.
3. The concentration of the elements presented generally increase downward through the C-horizon. It is not clear whether this is a primary or secondary geochemical signature (i.e., a primary change in till composition that is a reflection of proximity to bedrock or a secondary change that is a result of hydromorphic dispersal of elements downward in the section and its eventual concentration at the till/bedrock interface). Exceptions to this downward increase are usually attributed to changes in till facies which often display different grain size properties resulting in distinct geochemical response (e.g., site 93-AFB-137). Flow till facies generally contain lenses and stringers of sorted, coarser material. This coarser material tends to dilute the geochemical signature as most of the chalcophile trace elements tend to be enriched in the finer grain sizes.
4. The proportion of Ni and Cu consumed by the hydroxylamine hydrochloride leach in the  $-63\mu\text{m}$  fraction is quite high compared to that of the aqua regia digest. This suggests that a large proportion of the Ni and Cu is there in 'mobile' form and not bound tightly as sulphide minerals. Most of the stratigraphic patterns are similar between the 2 decompositions except at site 136 for

# Site 93-AFB-132

-63  $\mu$ m (Aqua Regia Digestion)



-63  $\mu$ m (Hydroxylamine Hydrochloride Digestion)



-2  $\mu$ m (Aqua Regia Digestion)

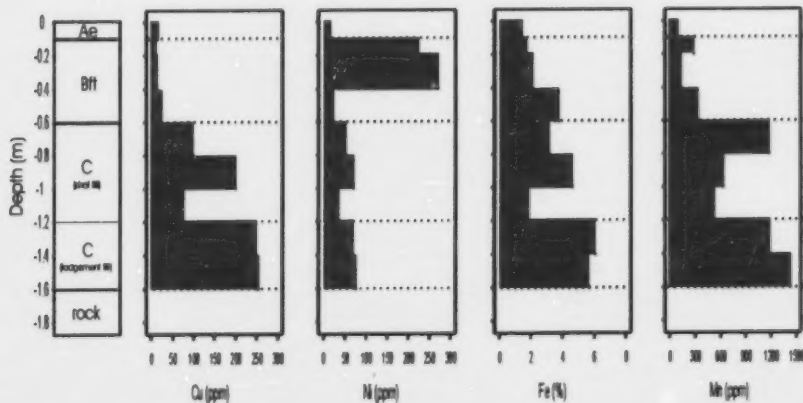
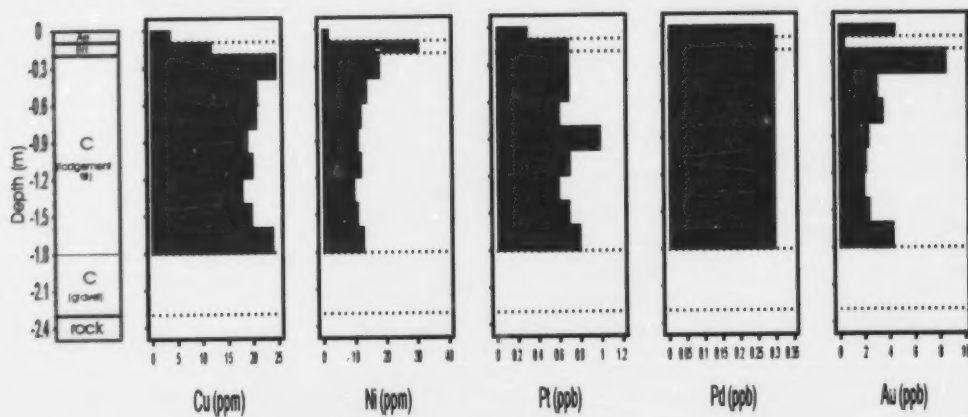


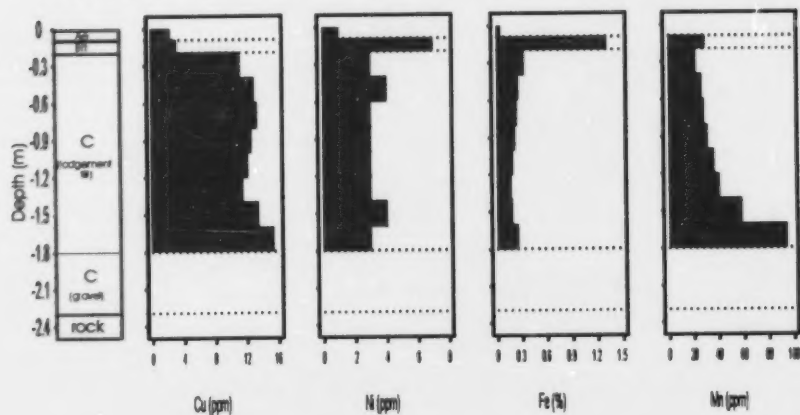
Figure 10. Detailed geochemical profiles at 7 selected sites.

# Site 93-AFB-134

## -63 $\mu$ m (Aqua Regia Digestion)



## -63 $\mu$ m (Hydroxylamine Hydrochloride Digestion)



## -2 $\mu$ m (Aqua Regia Digestion)

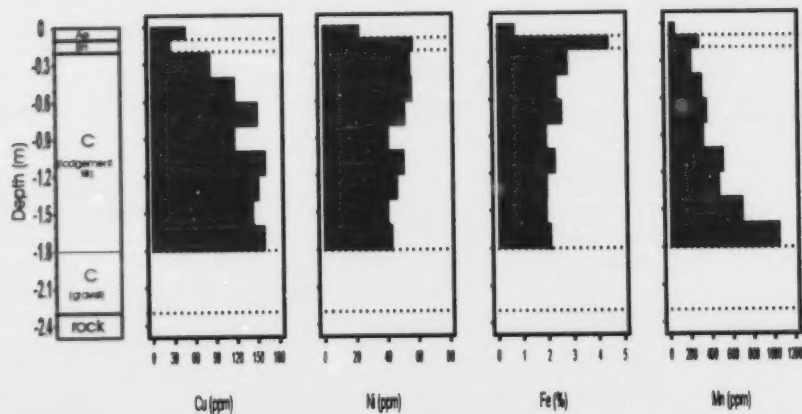
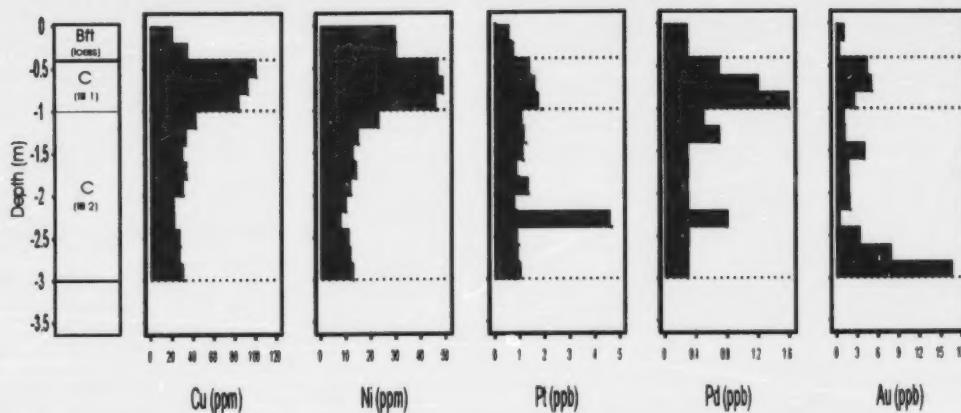


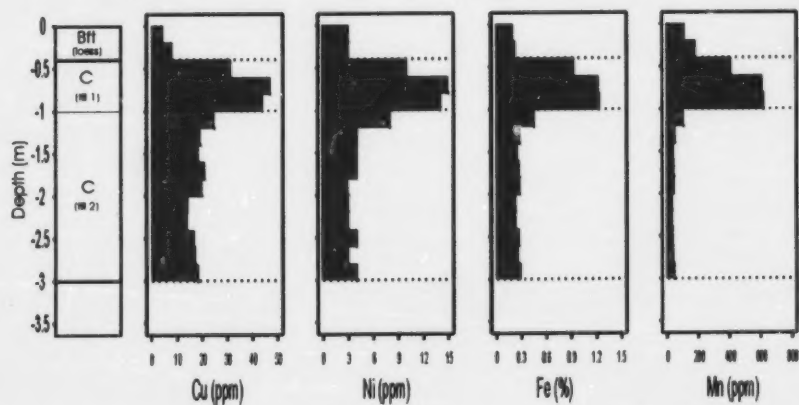
Figure 10, cont'd. Detailed geochemical profiles at 7 selected sites.

# Site 93-AFB-135

-63  $\mu$ m (Aqua Regia Digestion)



-63  $\mu$ m (Hydroxylamine Hydrochloride Digestion)



-2  $\mu$ m (Aqua Regia Digestion)

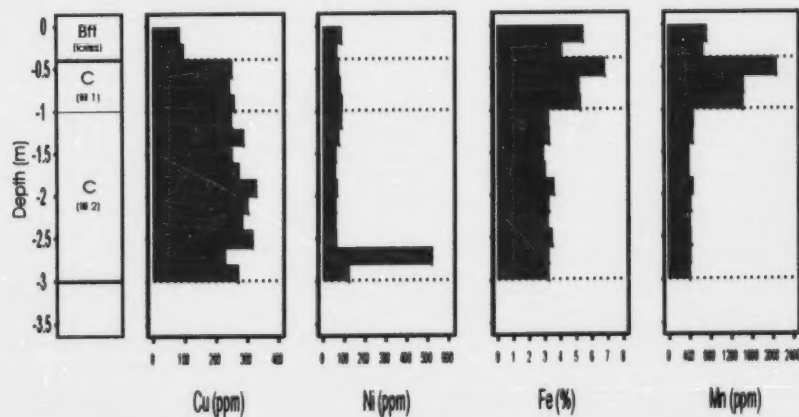
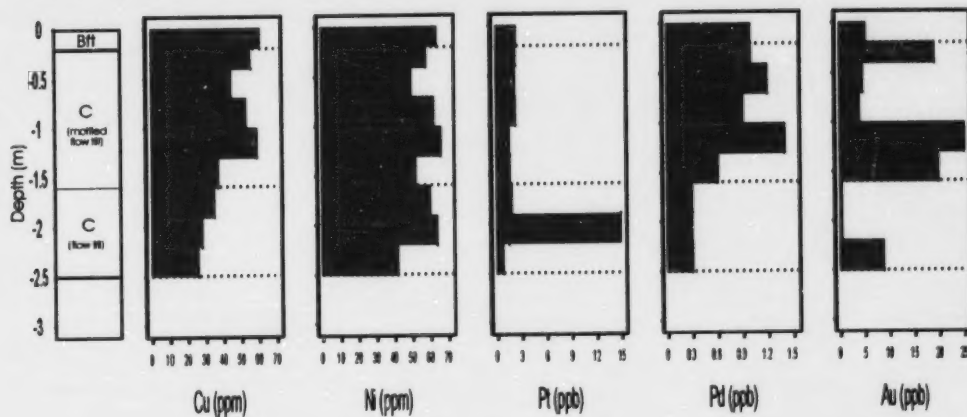


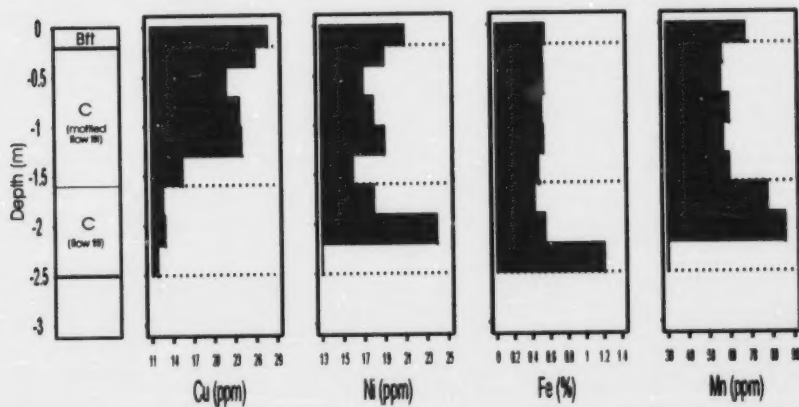
Figure 10, cont'd. Detailed geochemical profiles at 7 selected sites.

# Site 93-AFB-136

## -63 $\mu$ m (Aqua Regia Digestion)



## -63 $\mu$ m (Hydroxylamine Hydrochloride Digestion)



## -2 $\mu$ m (Aqua Regia Digestion)

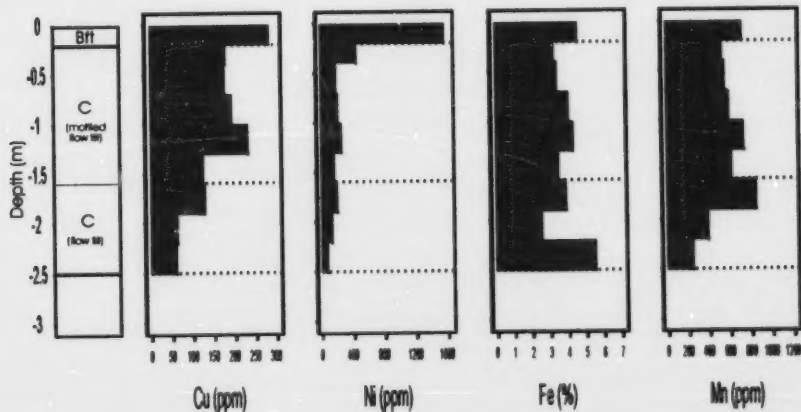
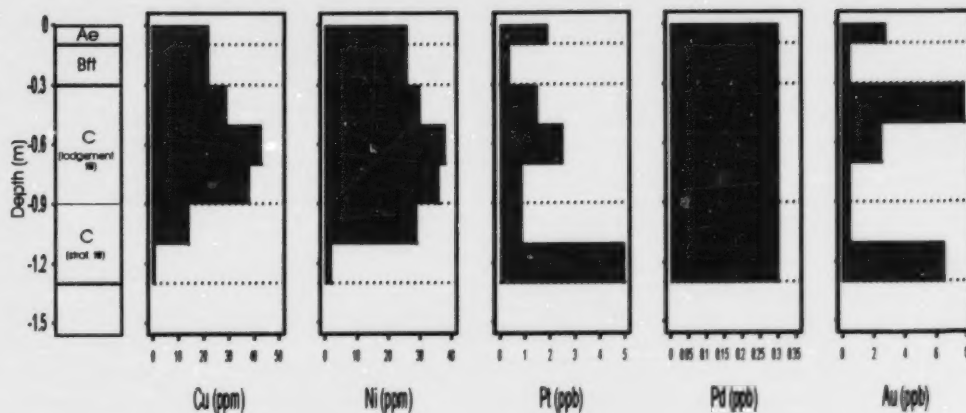


Figure 10, cont'd. Detailed geochemical profiles at 7 selected sites.

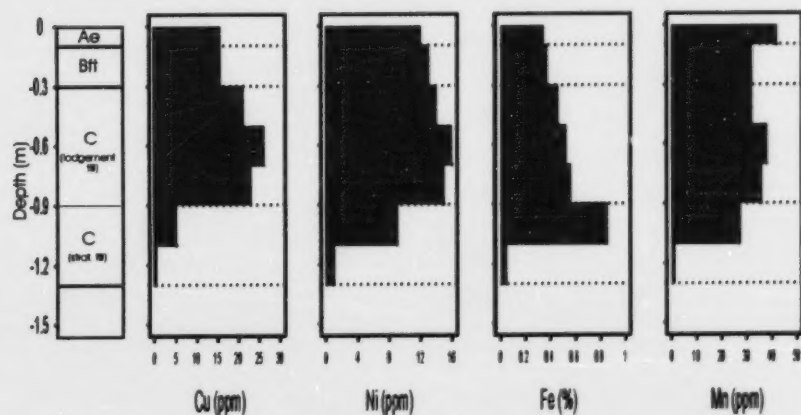


# Site 93-AFB-137

-63  $\mu$ m (Aqua Regia Digestion)



-63  $\mu$ m (Hydroxylamine Hydrochloride Digestion)



-2  $\mu$ m (Aqua Regia Digestion)

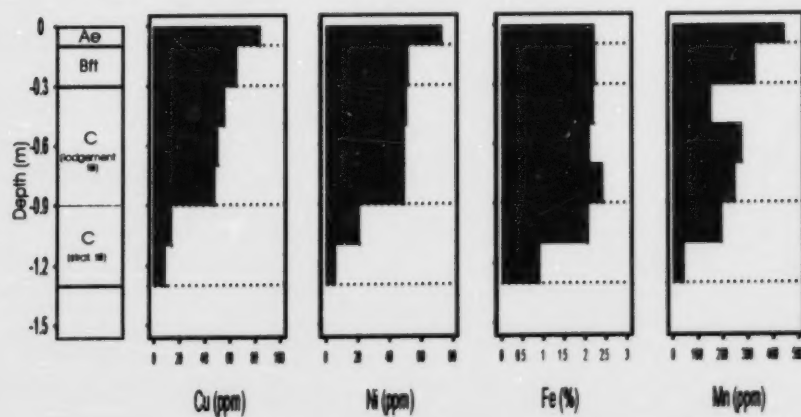
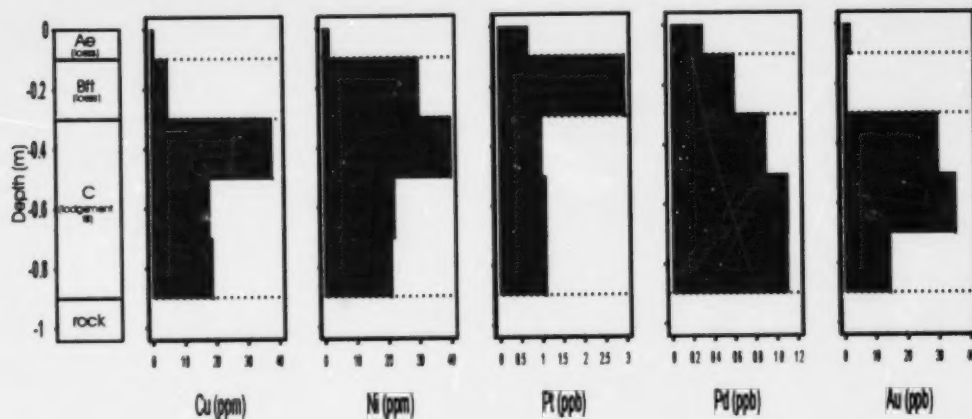


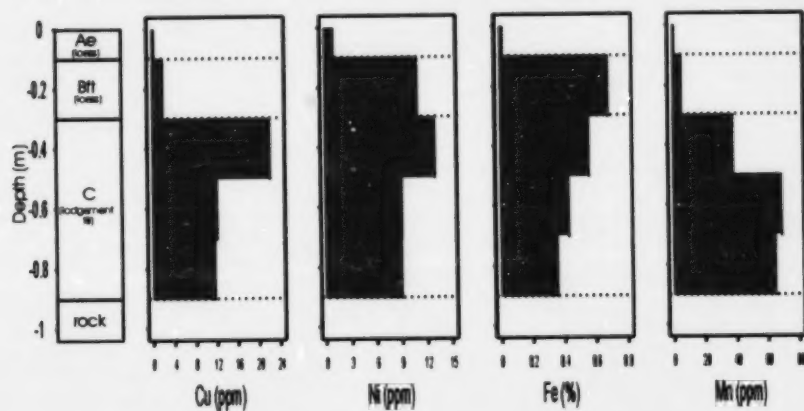
Figure 10, cont'd. Detailed geochemical profiles at 7 selected sites.

# Site 93-AFB-145

-63  $\mu$ m (Aqua Regia Digestion)



-63  $\mu$ m (Hydroxylamine Hydrochloride Digestion)



-2  $\mu$ m (Aqua Regia Digestion)

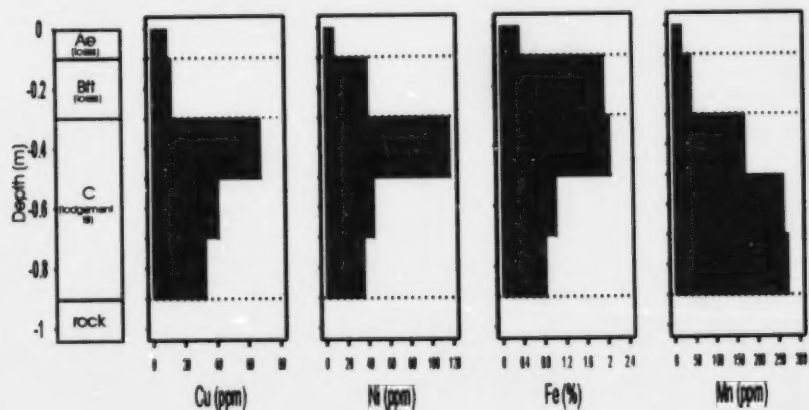
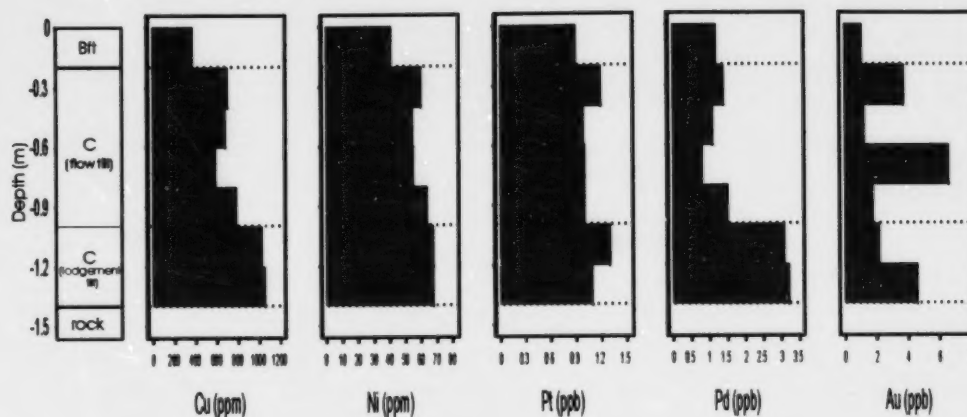


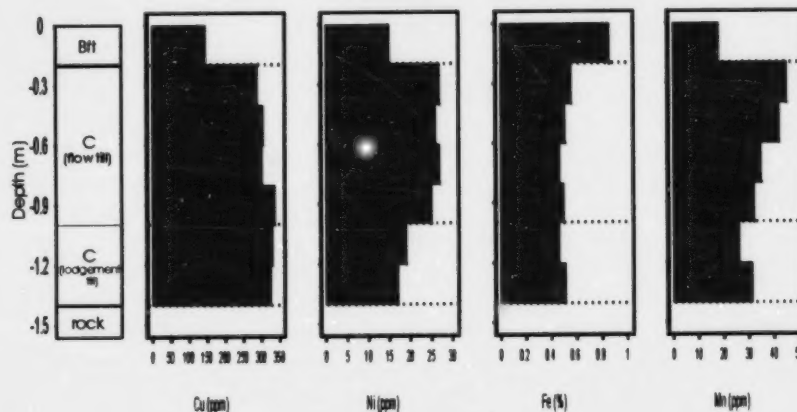
Figure 10, cont'd. Detailed geochemical profiles at 7 selected sites.

# Site 93-AFB-151

-63  $\mu$ m (Aqua Regia Digestion)



-63  $\mu$ m (Hydroxylamine Hydrochloride Digestion)



-2  $\mu$ m (Aqua Regia Digestion)

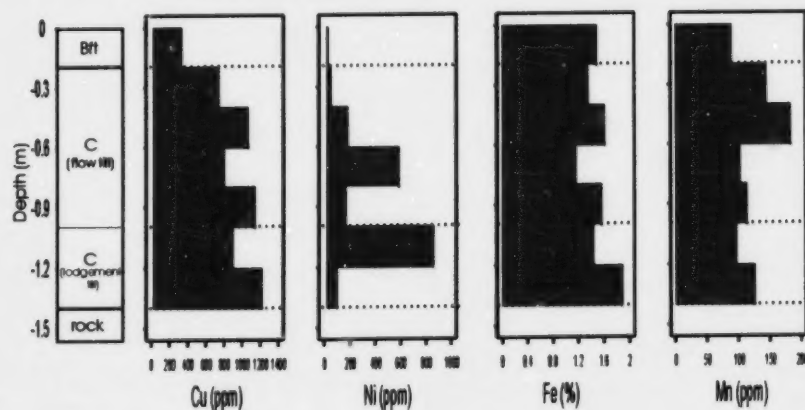


Figure 10, cont'd. Detailed geochemical profiles at 7 selected sites.

Ni where the lowest sample has the highest percentage of 'mobile' Ni (not related to Fe). This coincides with the high Pt by aqua regia.

Several conclusions can be drawn from this exercise. The geochemical profiles presented indicate that there are significant geochemical variations within the upper 1 to 2 m of till sections present within the Sudbury region. This has significant implications for programs of mineral exploration utilizing surficial geochemistry and drift prospecting techniques. Because of the inconsistent changes that occur within soil profiles, it is recommended that till which is least altered be sampled for geochemical analysis. This means that one should sample homogenous till from as deep within the profile as possible. Should an accumulation of Fe and Mn oxides be present at the bedrock/till interface, this may indicate the transport pathway of oxidizing groundwater, rich in chalcophile elements. At one site, orangy-brown till collected from the bedrock interface returned anomalously high concentrations of Ni, Cu and the PGEs. One should be aware of the possible effect of sampling this material on geochemical response. Unoxidized material immediately above this horizon should also be collected to confirm the geochemical response.

The profile sampling provided limited information on the mobility of Pt and Pd in the surficial environment. Distinct differences in the Pt and Pd content of A-, B- and C-horizons suggests that the elements are migrating according to local Eh-pH conditions. In theory, based on Eh-pH diagrams and thermodynamic data, Pt is less mobile than Pd in the surficial environment (Fuchs and Rose 1974). Mobility requires acidic soil conditions which exist within the Sudbury region. The mobility of Pt and Pd is further enhanced in areas where the chloride content of the groundwater is high, resulting in the development of Pt and Pd chloride complexes (Fuchs and Rose 1974). This factor probably doesn't play a role in PGE mobility within the Sudbury region.

Surface soils developed on till proximal to mineralization at the Stillwater Complex in Montana are generally depleted in Pd confirming its enhanced mobility (Fuchs and Rose 1974). Similar observations were recorded in soils developed over mineralized bedrock at Lac Sheen, Quebec (Wood and Vlassopoulos 1990; Cook et al. 1992). In a geochemical study of soils developed over several Pt and Pd occurrences in southern British Columbia, there was limited evidence to suggest that Pt was being remobilized or partitioned into a particular soil horizon or size fraction (Fletcher 1989). At one of these sites (Tulameen ultramafic complex), however, there was a suggestion that Pt was being hydromorphically dispersed out of upland soils and accumulating in bogs in adjacent lowlands (Cook and Fletcher 1993). As part of a surficial geochemical study over the River Valley intrusion east of Sudbury, it was found that Pt/Pd ratios in anomalous humus, B- and C-horizon till samples collected over mineralization were consistently lower than those of the source rocks (Tardif 2000). Differential rates of Pt and Pd mobility are suggested by this observation.

## Element Associations

Pearson linear correlation matrices were constructed for the total and partial geochemical datasets of humus, B- and C-horizon till and the non-magnetic HMCs of C-horizon till. Datasets were log transformed prior to analysis to reduce the effects of skewed populations on the determinations of r-values. Correlation matrices were constructed for each of the 7 geochemical datasets to determine the relationship between 16 ore and pathfinder elements (intraelement associations). Correlation matrices were also constructed for each of the 16 elements to determine the correlation between media and digestions (intramedia and inradigestion associations). The matrices are presented in Appendix N.

## INTRAELEMENT ASSOCIATIONS

The best indicators of Ni-Cu and precious metal mineralization are the elements themselves. In addition, a number of pathfinder elements are also associated with mineralization for the various sample media and digestions used.

In the case of the aqua regia dataset for humus, the ore-forming elements correlate extremely well with each other. In addition, Ni, Cu, Pt, Pd and Au show strong correlations with Co and Fe. The hydrides Bi-As and Sb also correlate well with each other although not with the ore-forming minerals. For the sodium pyrophosphate digestion, the ore-forming elements Ni and Cu correlate well with each other. Strong correlations also exist between Ni-Cu and Fe.

The B-horizon geochemical datasets display weaker intraelement correlations. All of the correlation coefficients for the aqua regia dataset are less than 0.7 and only a few are greater than 0.6. The strongest correlations of the pathfinders occur between Ni and Cr-Co. The ore-forming elements correlate fairly well with each other. Cr correlates relatively well Co and Fe. For the hydroxylamine hydrochloride leach, all *r*-values are less than 0.6. Aside from the moderate to weak ore-forming element correlations, Ni correlates fairly well with Co and Cr with Fe. It is likely that the low degree of correlation in the B-horizon geochemical datasets is a function of the varying degrees of soil development to which the samples have been subjected (i.e., accumulation versus depletion of metals within the horizon).

The C-horizon data should display relationships consistent with those observed in the local bedrock. Evaluation of the correlation matrices for C-horizon till does in fact confirm this assumption. For the aqua regia digestion, stronger correlations exist between the ore-forming elements as well as between Ni and Cr-Co. Fe also correlates fairly well with Cr-Co and Mn. For the hydroxylamine hydrochloride leach, Ni correlates well with Cu and Co, Cr correlates well with Fe and Co correlates well with Mn.

Aside from Pt and Pd, the correlation matrix for the non-magnetic HMC of till shows weak correlations between the ore-forming elements and moderately strong correlations between Ni and Co and As and Sb. The lack of correlation between the ore-forming elements is probably a result of the destruction of their associated sulphides by surface weathering and their translocation to other residence sites either proximal or distal to the sampling site.

## **INTRAMEDIA AND INTRADIGESTION ASSOCIATIONS**

Evaluation of the intramedia and intradigestion correlation matrices has resulted in a number of interesting observations. Firstly, the correlation between media is generally poor. The lack of correlation between the humus datasets and those of B- and C-horizon till and HMCs is attributed to anthropogenic loading of humus by airborne colloidal sulphide particles emitted from the smelters at Falconbridge, Coniston and Copper Cliff. The correlation between B- and C-horizon till and HMCs is slightly better, owing to the similarity of medium in that they are all of a mineral nature and to the absence of contamination from external sources.

The correlation between digestions for similar media also tends to be strong. This suggests that the proportion of metals bound by humic and fulvic acids, in the case of humus and by amorphous oxides and hydroxides of Fe and Mn in the case of B- and C-horizon soils is similar between samples.

An important question that needs to be addressed is whether the selective extractions are providing additional information. Selective extractions are known for their ability to enhance contrast between anomalous and background populations. As part of a statistical comparison of the near total, aqua regia versus partial datasets, a regression analysis was performed on the data to determine its deviation from a linear model (Cheng et al. 1997). If the near total and partial datasets were determined to be completely correlatable and did not have significant differences, then a map of the residuals would be expected to be random. A spatial U-statistic was applied to the residuals for anomaly enhancement. The resulting plots of U-values of residuals for Ni and Cu in C-horizon till display strong correlations with areas of known mineralization (Cheng et al. 1997). A number of additional exploration targets are also outlined. The apparently organized nature of the residual plots suggests that the selective extractions yield enhanced information. Further analysis is required to determine the nature of the information gained.



# Natural Versus Anthropogenic Geochemical Signatures

Ores of the Sudbury mining camp have been smelted for nearly 100 years at facilities located in Copper Cliff, Coniston and Falconbridge. Prior to the decommissioning of the Coniston smelter nearly 3 decades ago, approximately 1.5 to 2.7 million tonnes of SO<sub>2</sub> were emitted per year from the Sudbury area smelters, with Ni and Cu emissions estimated to be approximately 1100 tonnes per year (Cox and Hutchinson 1981). Despite the construction of Copper Cliff's 381 m tall superstack in 1972, 40 to 50% of the metallic particulates emitted from the stack continue to be deposited within a 60 km radius (Freedman and Hutchinson 1980). This anthropogenic loading of metals has impacted strongly on Sudbury's surficial environment. Extensive areas surrounding the 3 smelters remain barren to semi-barren as a result of the severe environmental conditions. Prevailing winds from the north-northeast between November and April and from the southwest between May and October have dispersed the signatures of the smelting operations along the main trends of the prevailing winds.

Remote sensing and regional surficial geochemical surveys have clearly delineated a "zone of influence" emanating from the Sudbury region. For example, a Landsat TM image of the Sudbury region presented in grey shades shows 3 distinct areas centred on the Copper Cliff, Coniston and Falconbridge smelters which have been strongly affected by atmospheric fallout (Figure 11). A significant proportion of the signature stems from the days when open-bed roasting of ores was common practice. Well-defined plumes extending both northeastward and southwestward from the smelter facilities are recognizable on this image.

The national geochemical reconnaissance (NGR) for lake sediments undertaken by the Geological Survey of Canada clearly delineates an area both northeast and southwest of the Sudbury region that is enriched in Ni (Friske et al. 1997). This area extends from the north shore of Lake Huron northeastward through Sudbury toward Lake Temagami and Lady Evelyn Lake. Most lake sediment samples collected from this region exceed the 95<sup>th</sup> percentile of over 18 000 lakes sampled across north-central Ontario. A portion of the geochemical signature southwest of Sudbury may be related to the glacial dispersal of mineralized rock.

## THE MULTI-MEDIA APPROACH

It may be possible to distinguish geochemical responses related to lithologic trends from those related to anthropogenic sources by comparing responses in humus to those of relatively unaltered C-horizon till. This approach was used in a separate study in the vicinity of a base metal smelter in Flin Flon, Manitoba (McMartin et al. 1999). The comparison is, however, based on the assumption that the geochemical response of till at 1 m depth is minimally affected by anthropogenic sources of metals. At Flin Flon, it has been shown that a component of surface contamination can extend up to 45 cm below the surface (Henderson et al. 1998).

The geochemical signatures of humus and C-horizon till along the north and east ranges of the Sudbury basin show high-resolution patterns of natural and anthropogenic geochemical variation. A geochemical plot of Ni in humus (Figure 12a) clearly defines an area south and west of Wanapitei Lake which contains elevated background concentrations. This response is likely a direct result of atmospheric fallout of colloidal sulphide particles derived from local smelter emissions. Subsequent oxidation of the sulphides releases their metals into a bioavailable state where they are readily adsorbed by humic and fulvic acids present within the decaying forest litter and underlying humus. Elevated background levels of all the major and accessory elements associated with Sudbury ores occur within this area. These include Ni, Cu, Pt, Pd, Au, Cr, Co, Ag, As, Te, Bi and Se. Stressed vegetation is also indicated on the Landsat TM image within this area of influence. Similar patterns were observed in a separate study (Dudka et al. 1995) whereby composite, surface soil samples (0–20 cm depth) were collected from a broad region encompassing the Copper Cliff, Coniston and Falconbridge smelters.

The C-horizon till data for Ni (Figure 12b) is markedly different from that presented by the humus. The dataset clearly defines areas where primary sources of metals occur in bedrock. Glacial dispersal from

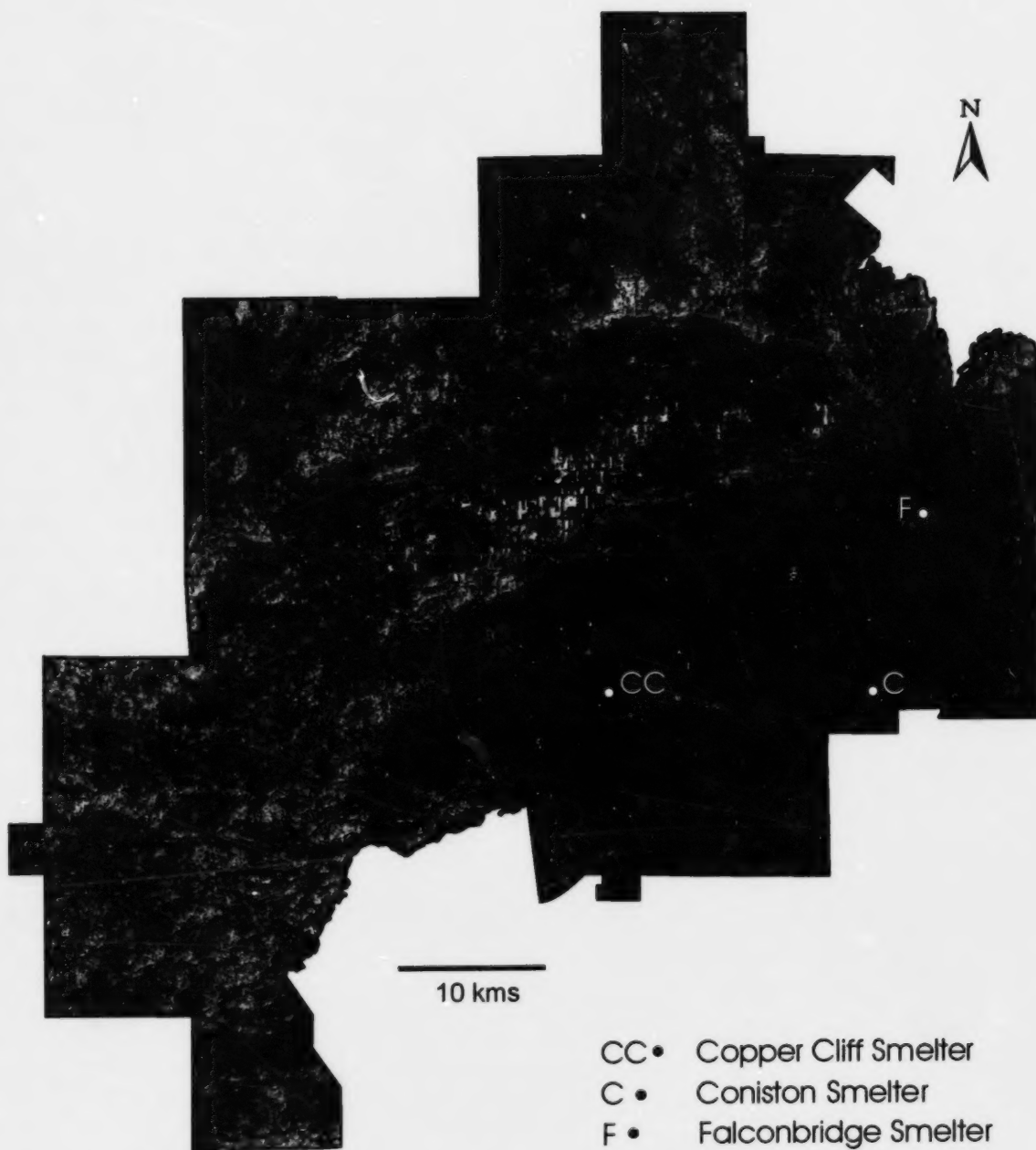


Figure 11. Grey scale Landsat TM image of the Falconbridge-Wanapitei Lake area.

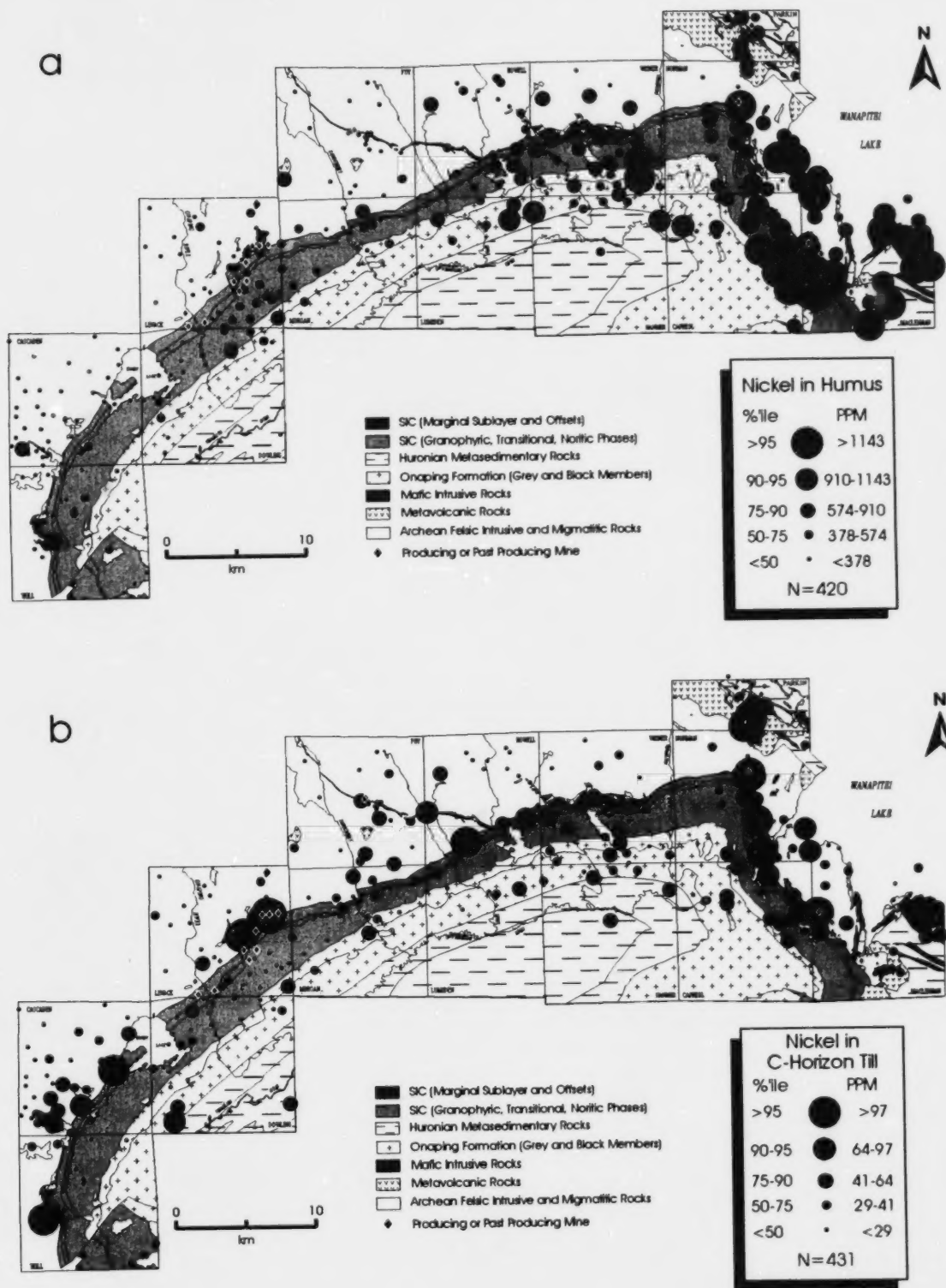


Figure 12. Regional distribution of nickel in: a) humus and b) C-horizon till (aqua regia digestion).

these point sources is generally short (i.e., <1 km). Notable areas of elevated Ni in till occur: in Cascaden Township adjacent to the Ministic offset; in Levack Township centred on the Levack mine complex; on the east range, in close proximity to the Whistle Mine in Norman Township and the Victor and East Rim mines in Maclellan Township; and on the Parkin Offset in Parkin Township along which the Milnet Mine is situated. Similar geochemical patterns are indicated by the Cu, Pt, Pd and accessory element datasets. There is no apparent indication of anthropogenic loading registered in any of these C-horizon datasets. In addition, the B-horizon datasets display patterns which are very similar to those depicted by the C-horizon till. That is, there is very little direct evidence to suggest that the composition of the B-horizon has been significantly altered by anthropogenic loading.

## THE SELECTIVE LEACH APPROACH

Sequential selective extractions have been widely used in exploration and environmental geochemistry to determine the residence sites of elements in surficial media (Chao 1984). The procedures are best suited for differentiating between elements held in "labile" or secondary phases from those more strongly held in "non-labile" phases. Sequential extractions are therefore well suited for environmental geochemistry applications where it is important to differentiate between natural (primary) and anthropogenic (secondary) signals. A complete sequential extraction scheme, including the extractants used and phases dissolved, is presented in Table 4.

Rather than employing the complete sequential extraction scheme to all samples collected from the study area, the authors chose to use only 2 of the selective extractants in addition to a standard, near total, aqua regia digestion. The selective leaches used for the organic and mineral soils were specifically chosen to target important labile phases. In the case of humus, a 0.1 M solution of sodium pyrophosphate was used to liberate the metals bound to humic and fulvic acid complexes within the soluble organic fraction. An insoluble residue carrying metals in both labile and non-labile phases remained following this extraction (Table 4). The sodium pyrophosphate extraction was chosen specifically for humus to avoid the problem of digesting particulate mineral matter in samples collected from areas affected by local smelting, milling and logging activities. Humic and fulvic acids also act as excellent scavengers of metals in the surficial environment. Plots of their metal contents should therefore enhance anomaly definition.

Hydromorphically dispersed metals are readily adsorbed by secondary oxyhydroxides of Fe and Mn which form in mineral soils. The relative abundance of metals contained within this phase can therefore provide information on gains and losses within particular soil horizons. The amorphous Fe/Mn oxyhydroxide phase of B- and C-horizon samples was extracted using hydroxylamine hydrochloride in 0.05 M HCl after first removing elements bound as adsorbed, exchangeable or within carbonates using a sodium acetate leach.

The aqua regia digestion is considered a near-total digestion capable of releasing metals bound to organics, sulphides, arsenides, selenides, tellurides, sulphosalts, simple oxides and their hydrates as well as native Au, Pt and Pd. Natural U oxides, Ca phosphates and most sulphates (except barite) are solubilized as are some silicates (Hall 1991). The aqua regia digestion will therefore provide information on not only the metals contained within the soluble organic fraction of humus and the Fe/Mn oxyhydroxide phase of B- and C-horizon samples but a significant proportion of the remaining primary and secondary mineral phases as well.

Ratioing of the soluble organic component to the near-total (aqua regia) component of humus yields similar trends for both Ni and Cu (Figures 13a, b). For Ni, approximately 5 to 15% of the total geochemical response is accounted for by the soluble organic fraction. Copper shows a much broader range with 20 to 60% of the total signature being attributed to the soluble organic component. The insoluble residue therefore accounts for a significant proportion of the total Ni and Cu geochemical signatures. No information is available on the residency sites of metals within this fraction. For Ni and, to a lesser degree Cu, the highest ratios appear to be spatially associated with areas of mineral production as occur in the Levack mine complex area as well as in the vicinity of the Milnet, Whistle and Victor/Nickel

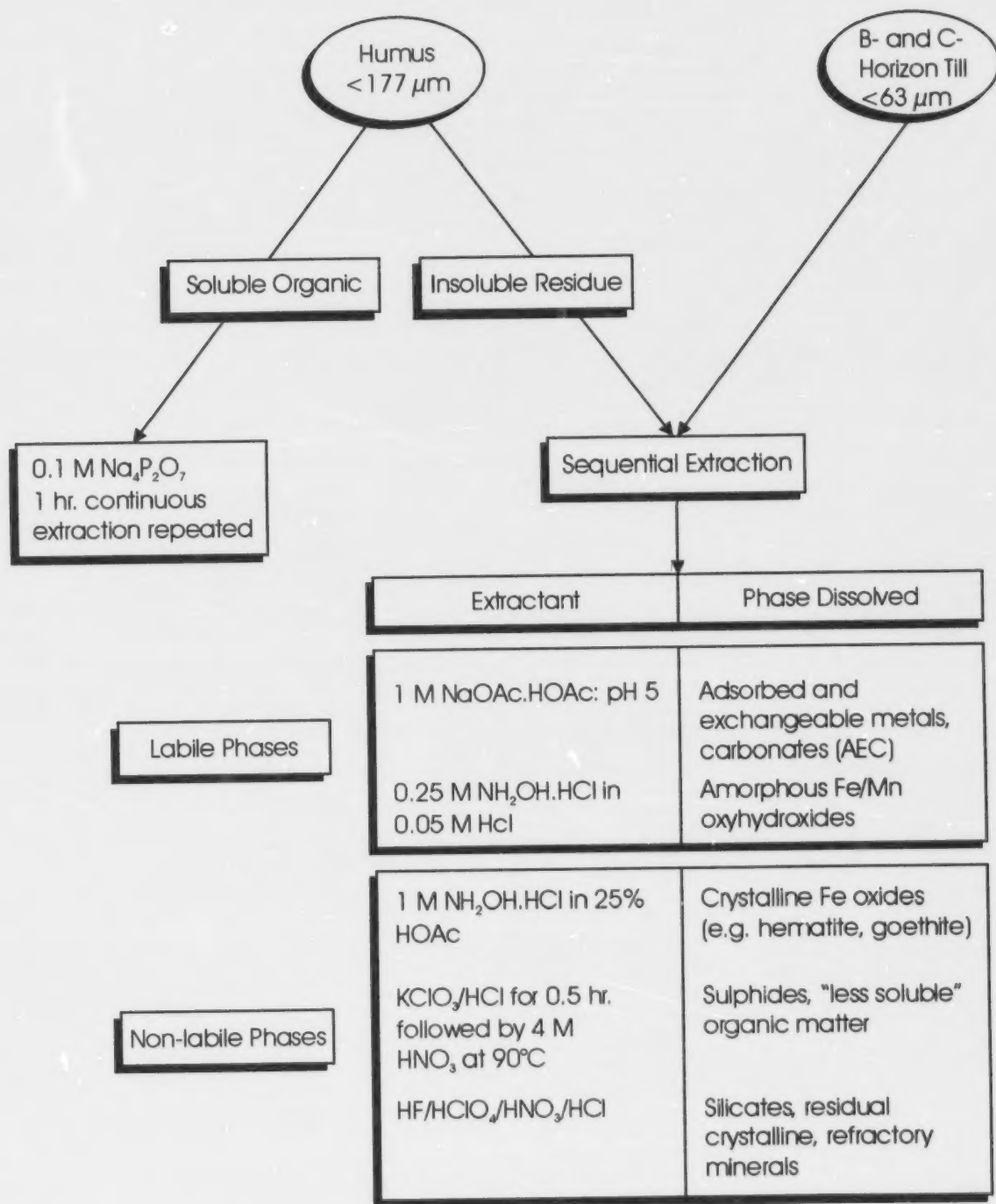


Table 4. Sequential extraction scheme for organic and mineral soils.



Rim mines to the east (Figure 14a). Humus samples collected from these areas also contain higher levels of organic carbon (Figure 14b). The elevated response in the soluble organic fraction may therefore be directly related to organic carbon content. It is unclear why the organic carbon content of humus is higher within these areas.

Ratioing of the Fe/Mn oxyhydroxide phase to the near-total (aqua regia) component of B- and C-horizon soils has provided information on the relative contribution of metals in a labile phase to the total geochemical signature (Figures 15a-d). In the case of Ni in the B-horizon, only 10 to 20% of the geochemical signal is attributed to the Fe/Mn oxyhydroxide phase. As with humus, the Cu ratios are generally higher ranging between 15 and 35% of the total. Similar differences between Ni and Cu were obtained in a separate study on the chemical and mineralogical forms of Cu and Ni in contaminated soils from the Sudbury mining and smelting region (Adamo et al. 1996). In this study, it was found that Cu occurs in the soils in more mobile forms than Ni. Approximately 75% of the Cu and 40% of the Ni signatures were associated with "non-residual" soil forms. At Lac Sheen, Quebec, more than 50%, and as much as 60 to 70% of the Cu and Ni in anomalous soil samples is present in complex organic species or in sulphides rather than in weakly bound labile phases (Cook et al. 1992).

The ratios for both the Ni and Cu populations of the B-horizon are normally distributed. For the C-horizon, the frequency histograms for Ni and Cu ratios indicate values slightly higher than their B-horizon counterparts. In most cases, there is an increase in the relative proportion of metals held in the oxyhydroxide phase from the B- to the C-horizon. There is a suggestion, especially in the Cu dataset, that the C-horizon consists of 2 populations (Figure 15d): one similar to that of the B-horizon and a second which might be a result of hydromorphic loading to the C-horizon. Spatial plots of the ratio of oxyhydroxide to total Ni and Cu concentrations are random for both the B- and C-horizon datasets. Spatial plots showing the relative change in this ratio between B- and C-horizon soils are also random (Figures 16a, b). This would suggest that areas being subjected to intense anthropogenic loading, as occur along the southern end of Wanapitei Lake, are not seeing a relative increase in hydromorphically dispersed metals in either the B- or C-horizon. The relative increase in Fe/Mn oxyhydroxide-held metals from the B- to C-horizon is likely a reflection of normal soil-forming processes whereby metals are leached from the Ae- and B-horizons and scavenged by oxyhydroxides in the upper C-horizon.

The changes in ratios observed vertically in sections sampled at high resolution are remarkably similar to those discussed above (Figures 17a, b). That is, the upper portion of the C-horizon generally contains a higher proportion of metals held in an Fe/Mn oxyhydroxide state than does the B-horizon. At one site (93-AFB-135), the Fe/Mn oxyhydroxide-held component accounts for over 50% of the Cu geochemical signature to a depth of 2.4 m at which point it drops off quickly. Interestingly, despite containing a much lower total metal content, the leached Ae-horizon often contains a higher proportion of the Fe/Mn oxyhydroxide component than does the B-horizon.

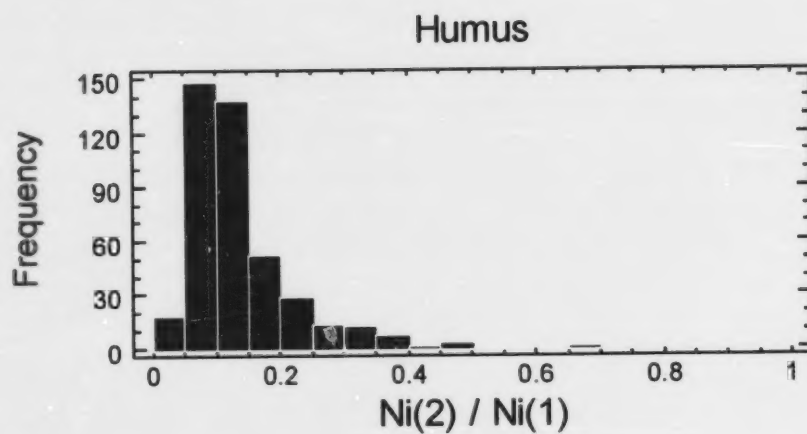
## Local Dispersal Patterns

The density at which till samples were collected in the immediate vicinity of known Ni-Cu-PGE mineralization was increased to determine the mineralogical and geochemical fingerprint of mineralization within surficial media. This information can then be applied to the interpretation of the regional datasets.

## PROPERTY-SCALE DISPERSAL

Higher density sampling was undertaken at 6 selected areas (Figure 2). These include: 1) the Strathcona Embayment in east-central Levack Township; 2) the Parkin offset in south-central Parkin Township; 3) the Whistle Embayment in north-central Norman Township; and 4) the Victor/Nickel Rim mines area in west-central McLennan Township. Slightly higher sampling density was also achieved around the Ministic Offset dike in southwestern Cascaden Township and the Foy Offset dike in central Foy Township. The patterns observed within these areas will be discussed briefly. Contact, footwall and offset dike styles of mineralization are represented by the 6 areas.

a



b

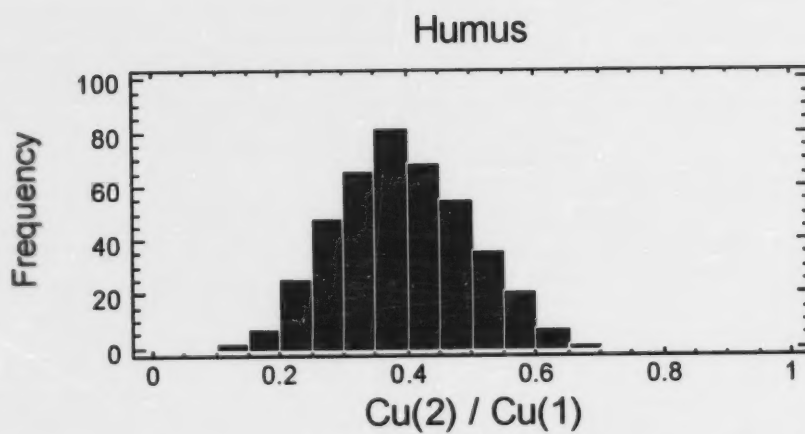


Figure 13. Frequency histograms of a)  $Ni(2)/Ni(1)$  and b)  $Cu(2)/Cu(1)$  in humus.

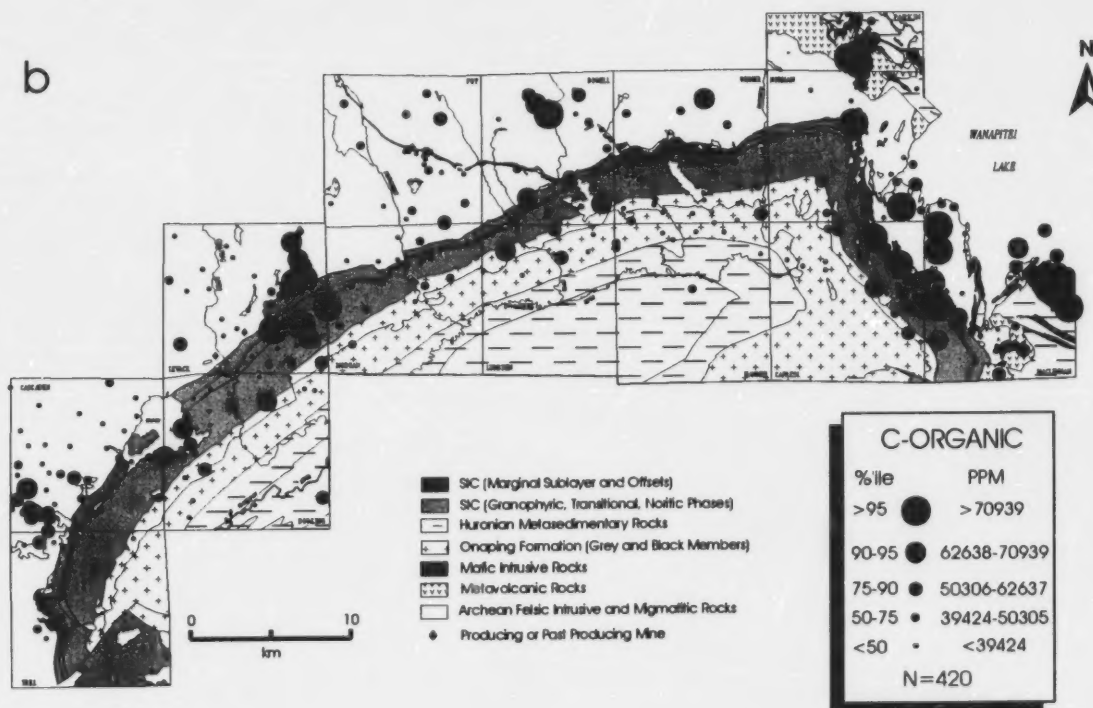
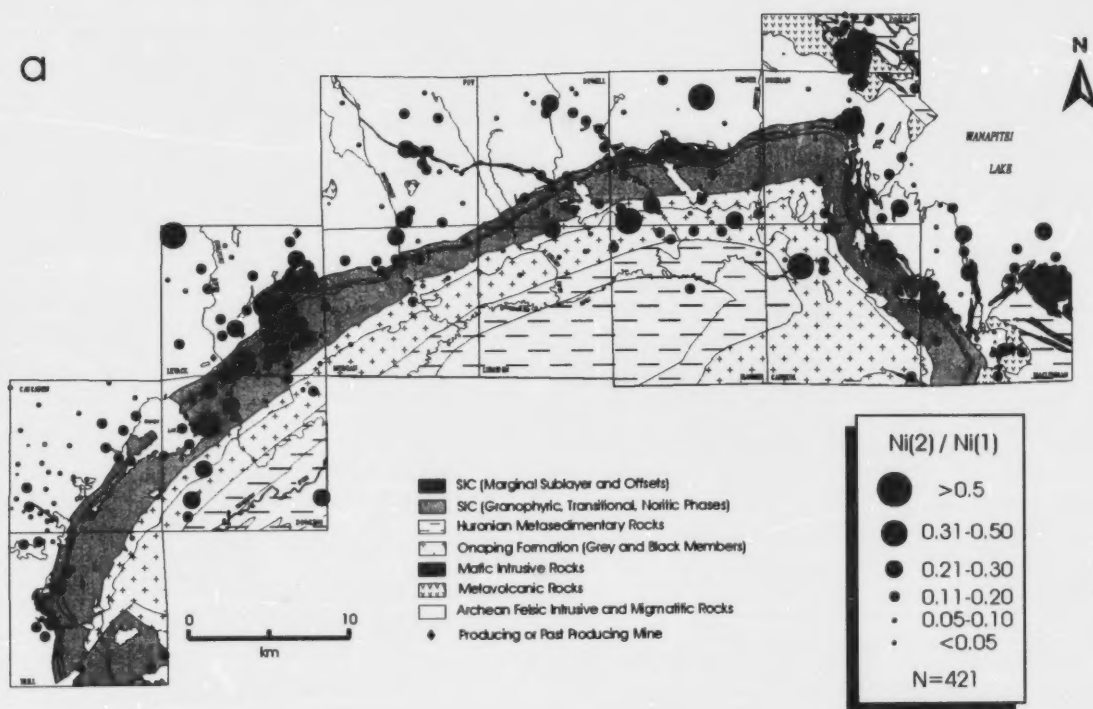


Figure 14. Spatial plots of a)  $Ni(2)/Ni(1)$  and b) organic carbon in humus.

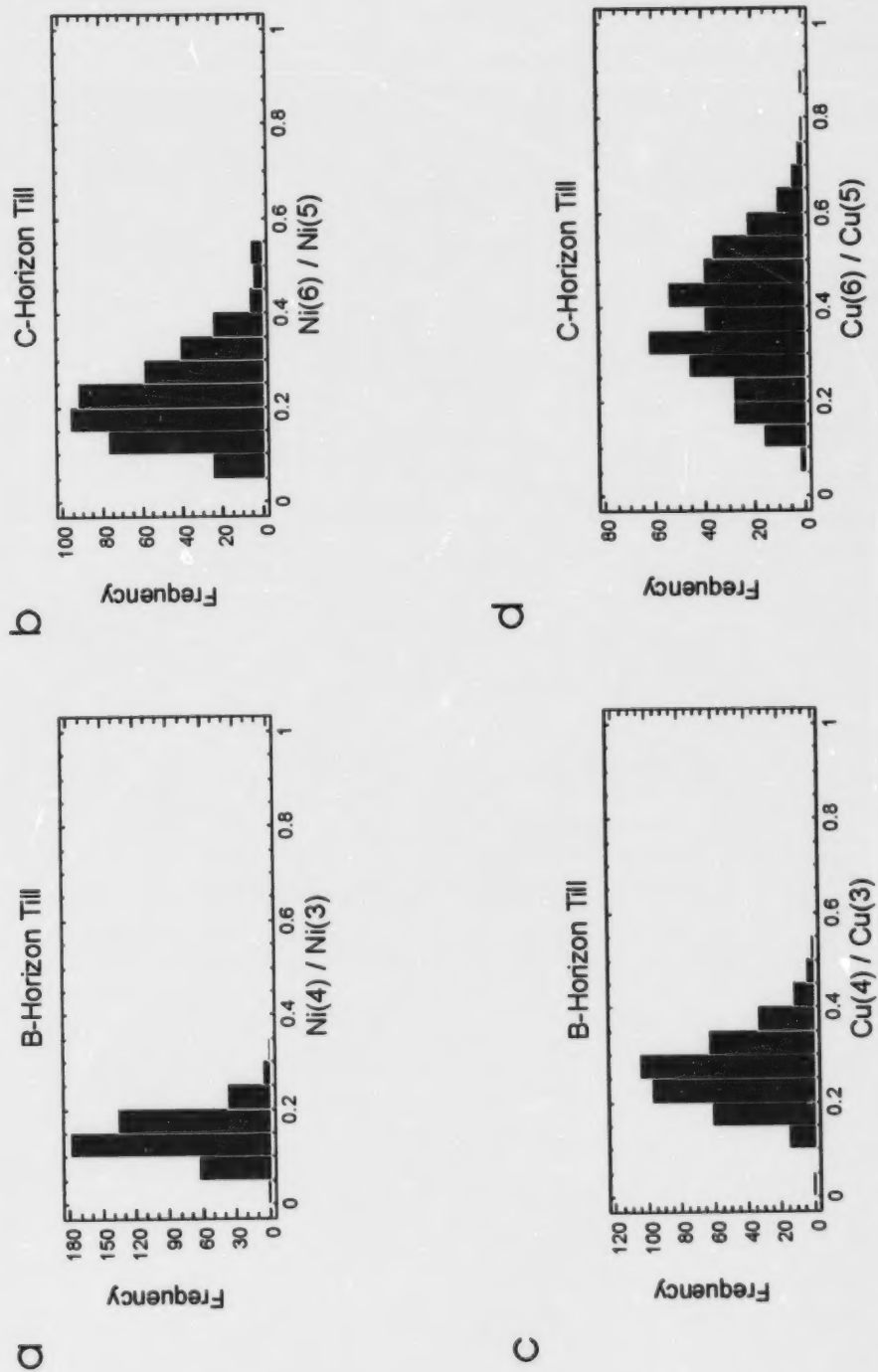


Figure 15. Frequency histograms of a)  $\text{Ni}(4)/\text{Ni}(3)$ , b)  $\text{Ni}(6)/\text{Ni}(5)$ , c)  $\text{Cu}(4)/\text{Cu}(3)$ , and d)  $\text{Cu}(6)/\text{Cu}(5)$ .

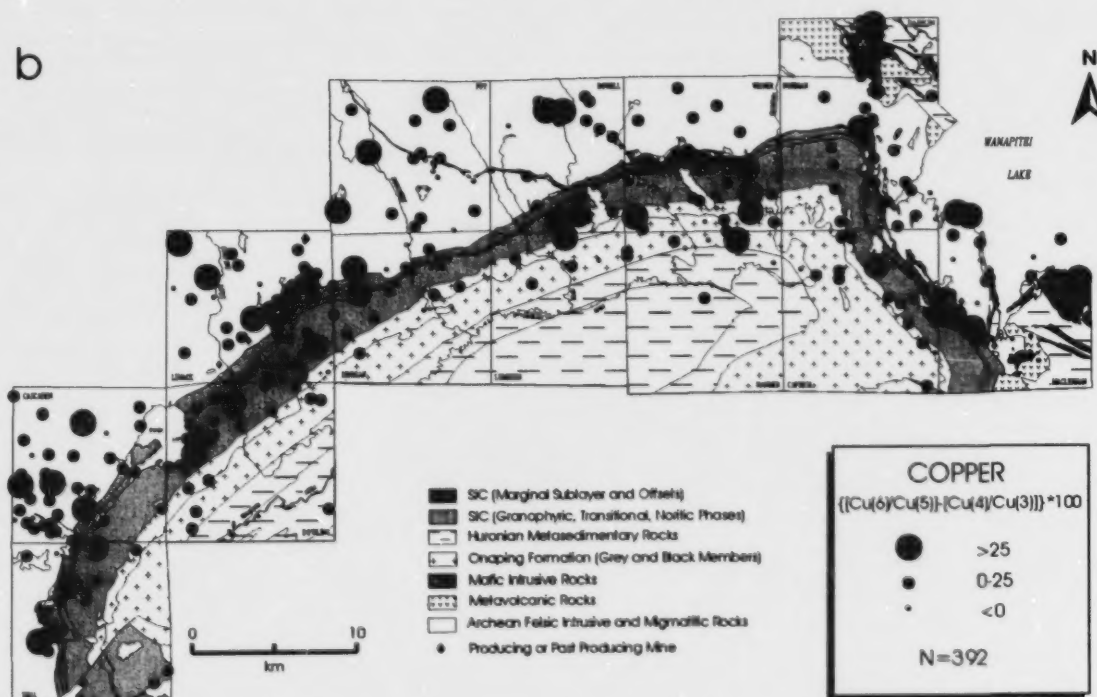
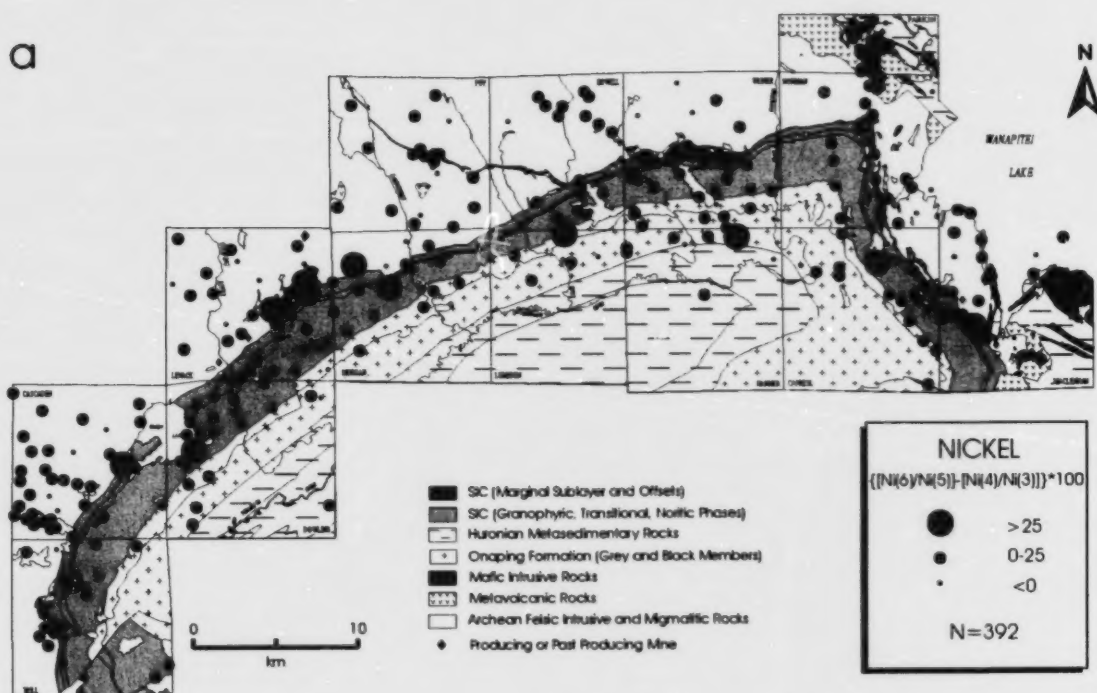


**Figure 16.** Spatial plots showing the relative change in amorphous Fe/Mn oxide held a) nickel and b) copper as one proceeds from the B- to C-horizon.



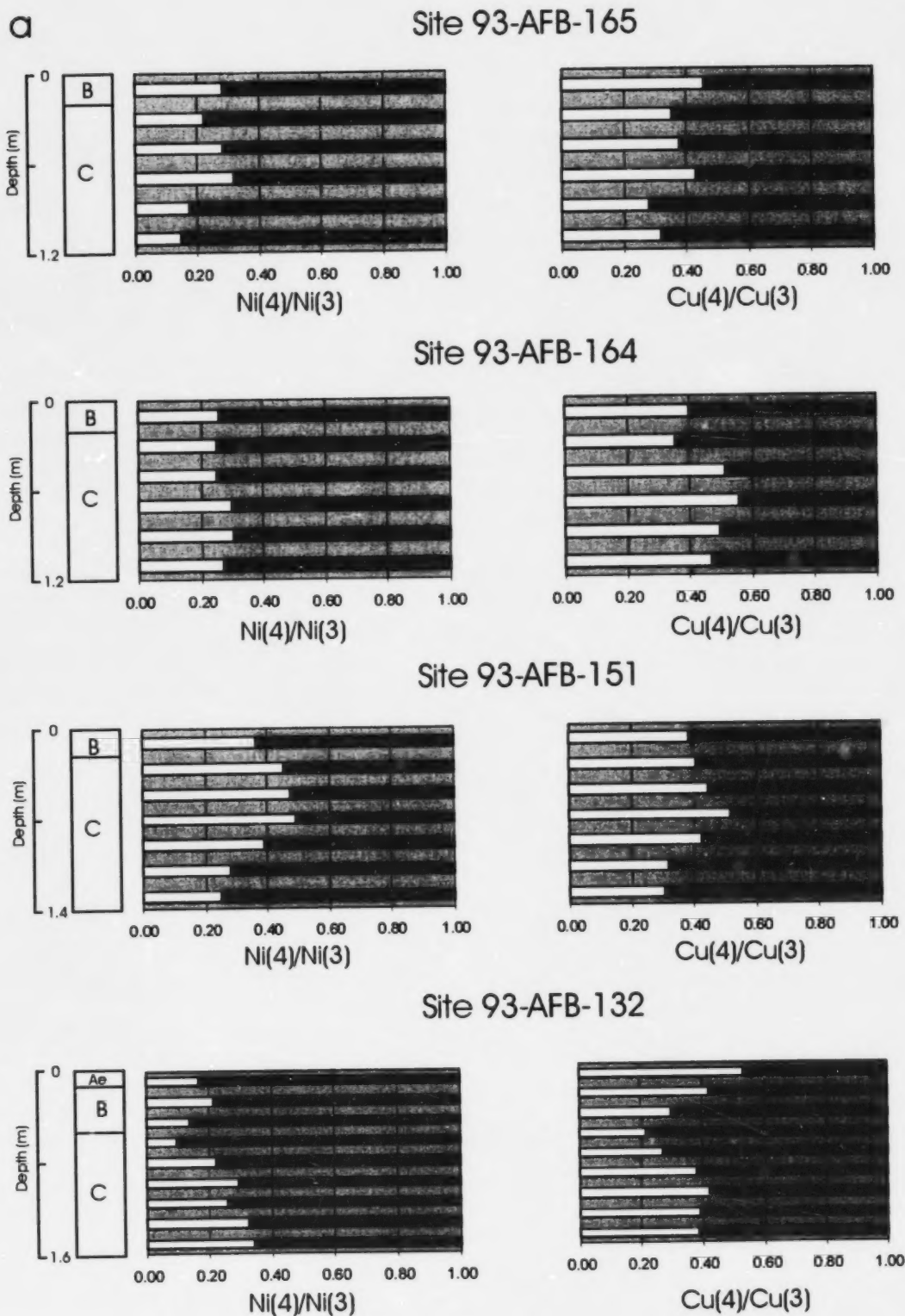
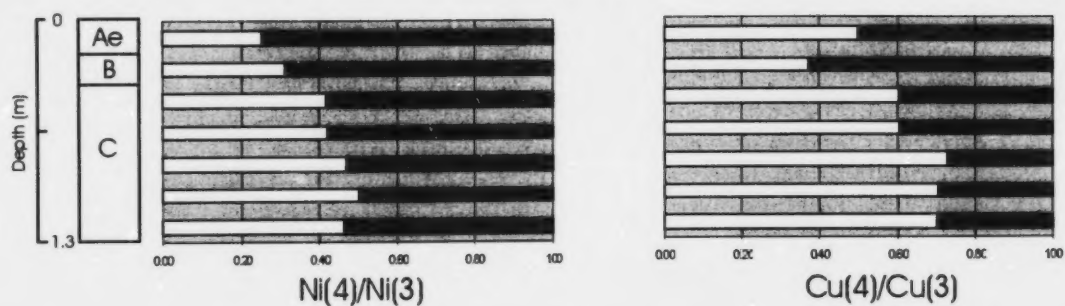


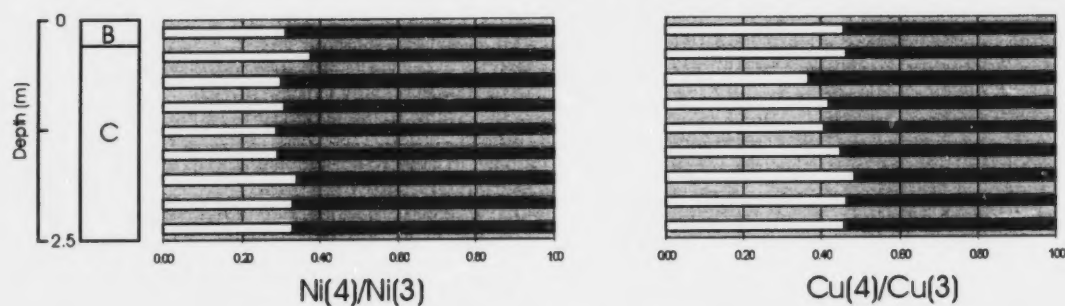
Figure 17. Detailed profiles of  $Ni(4)/Ni(3)$  and  $Cu(4)/Cu(3)$  at 8 selected sites.

b

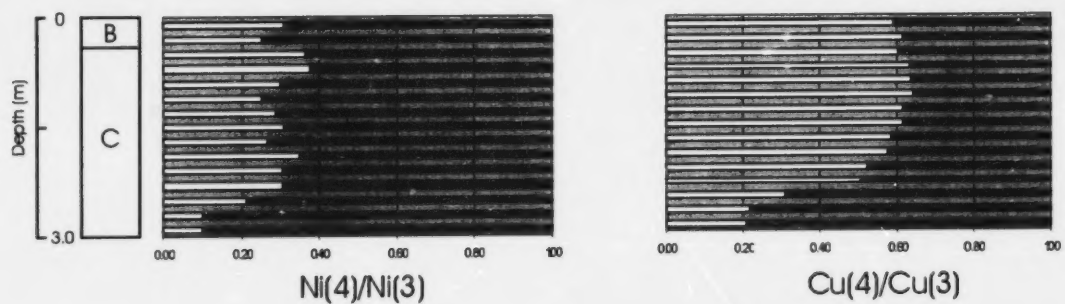
## Site 93-AFB-137



## Site 93-AFB-136



## Site 93-AFB-135



## Site 93-AFB-134

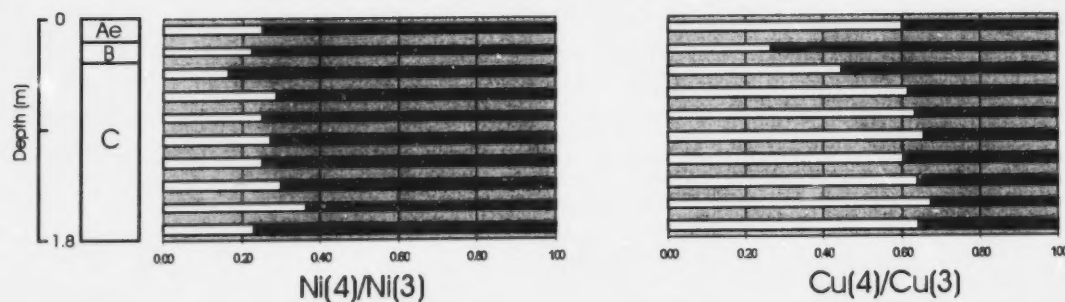


Figure 17, cont'd. Detailed profiles of Ni(4)/Ni(3) and Cu(4)/Cu(3) at 8 selected sites.

## Parkin Offset

Higher density sampling was undertaken in south-central Parkin Township in the vicinity of the Parkin Offset Dike. The Parkin Offset is a northeast-trending radial dike consisting of a series of sub-parallel anastomosing sheets of pyroxene-rich quartz diorite. The sheets range from less than a metre to 30 m in width and cut strongly brecciated Archean quartz porphyries, Huronian metasedimentary rocks and Nipissing gabbros. A discontinuous zone of sulphides dominated by chalcopyrite and pyrrhotite occurs along the outer margins of the dike. South of Malbeuf Lake, typical grab samples contain 2.75 wt.% Ni, 5.64 wt.% Cu, 7 ppm Pt, 4 ppm Pd and 2 ppm Au (Lightfoot et al. 1997). Values of up to 44 wt.% Cu, 23 ppm Pt and 1 ppm Pd have been reported from north of the lake. The sulphide veins range from 4 m down to a few cm in width and are elongated parallel to the Offset over distances of 50 to 100 m. Approximately 1 km north of Malbeuf Lake, the Parkin Offset abruptly changes direction to a northwesterly trend. The abandoned Milnet Mine is located at this flexure point. Mineralization occurs within and adjacent to brecciated quartz diorite and consists of massive to disseminated pyrrhotite, pentlandite, pyrite and chalcopyrite grading 1.49% Ni, 1.54% Cu, 2.3 ppm Pt and 3.0 ppm Pd (Meyn 1970).

The Parkin Offset area is characterized as a bedrock-dominated terrain. Till cover is thin, yet widely distributed making the area an excellent candidate for surficial sampling surveys. Samples were collected randomly at 51 sites at roughly a 200 m spacing on and adjacent to the Parkin Offset for a distance of about 3.5 km.

Figures 18 to 21 present the results of Pt and Pd analyses performed on humus, B- and C-horizon till and the non-magnetic HMC of C-horizon till samples collected within the Parkin Offset region. Several conclusions can be drawn from the visual inspection of these maps.

1. There is no apparent correlation between anomalous humus geochemistry and the position of the Parkin Offset dike. The geochemical signature of humus within this area is likely overwhelmed by the effects of local smelters.
2. B- and C-horizon till samples collected over the dike generally returned elevated to anomalous Pt and Pd values. Anomalous values are generally in the low ppb range with the highest Pt and Pd values being 11.7 and 15.7 ppb, respectively.
3. The geochemical signature of the non-magnetic heavy mineral fraction of C-horizon till displays a slightly weaker correlation with the known position of the Parkin Offset dike. Two samples collected over Nipissing diabase less than a kilometre southwest of the Milnet Mine also returned anomalous Pd values. These anomalies should be investigated further.
4. There is little, if any, evidence for down-ice dispersal of the Pt and Pd geochemical signature beyond a few hundred metres.

## Strathcona Embayment

A prominent outward bulge of the norite-footwall contact northeast of the town of Levack is referred to as the "Strathcona embayment" (Coats and Snajdr 1984). The embayment contains an unusually thick Sublayer and is host to a number of Ni-Cu-PGE deposits and showings. Producers and past-producers within the embayment include, from east to west: the Big Levack; Longvack; Coleman; Strathcona; Fraser; McCreedy East; North; Fecunis; and parts of the Levack ore deposits. Mineralization is primarily of the contact-type occurring mostly within Sublayer and adjacent footwall breccia. The ores are typically Ni-rich yielding Cu/Ni ratios of less than 1. At the Strathcona Mine, Cu and PGE-rich zones (Copper and Deep Copper zones) occur within the footwall up to 600 m from the SIC contact. Copper-rich veins at the Barnet showing, which is situated approximately 1.5 km northeast of the Strathcona head frame, may represent the surface expression of the Strathcona Copper Zone (Farrow 1994). Copper-rich footwall ores hosted by Sudbury breccia also occur at the McCreedy East deposit.

The Strathcona Embayment area is characterized as a bedrock-dominated terrain. Till occurs as a thin, discontinuous veneer on bedrock uplands and locally, thickens in troughs separating northeast-trending

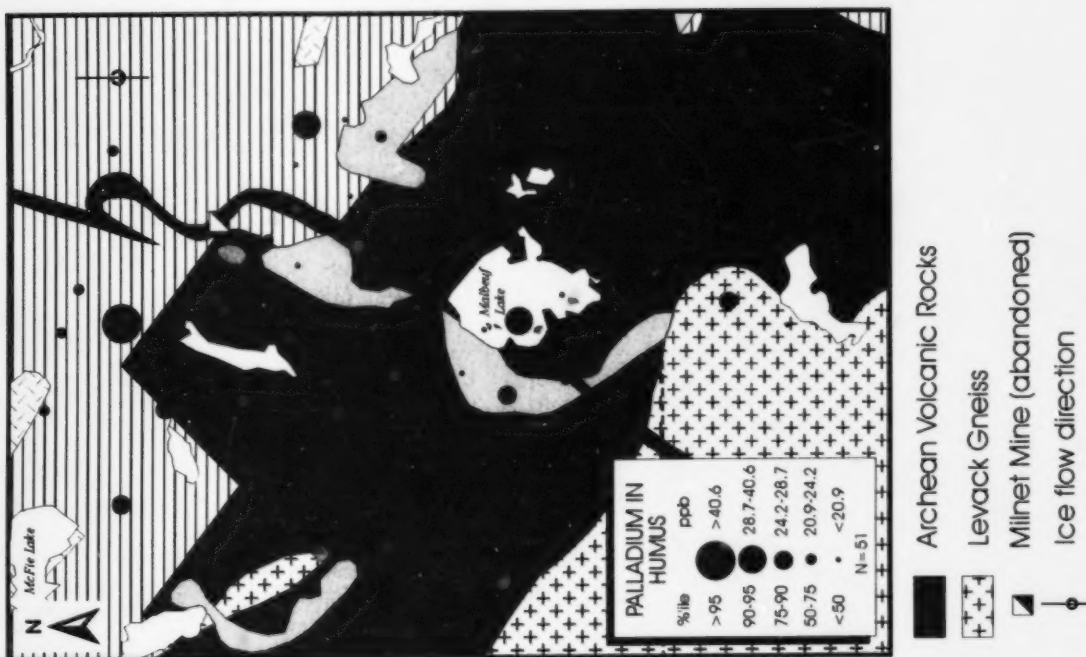
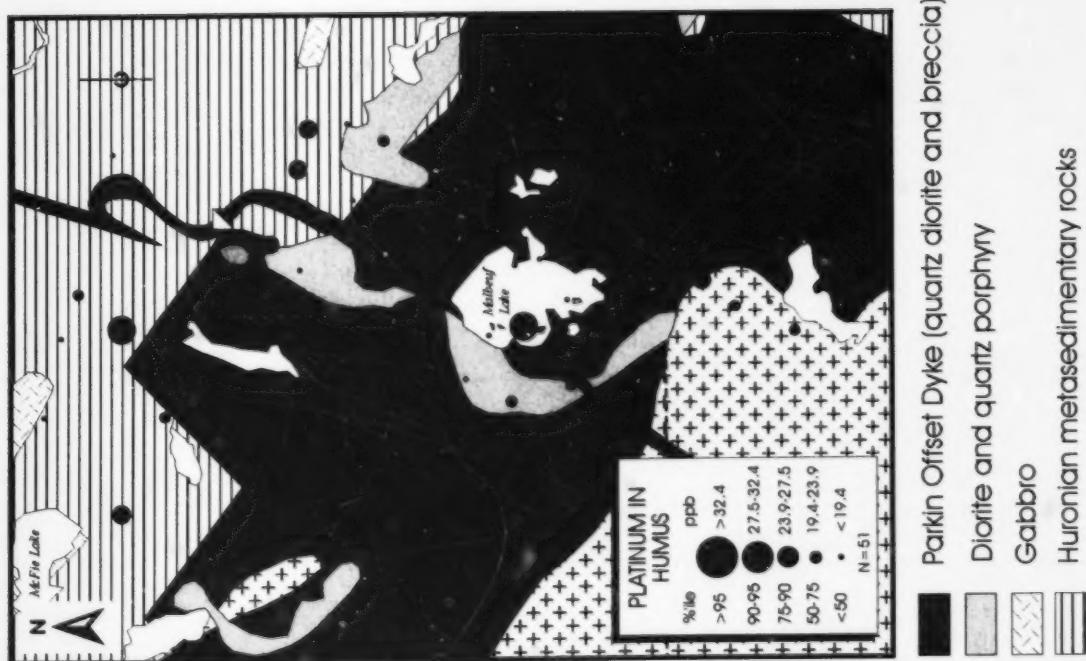


Figure 18. Spatial plots of platinum and palladium in humus (Parkin Offset orientation survey area).



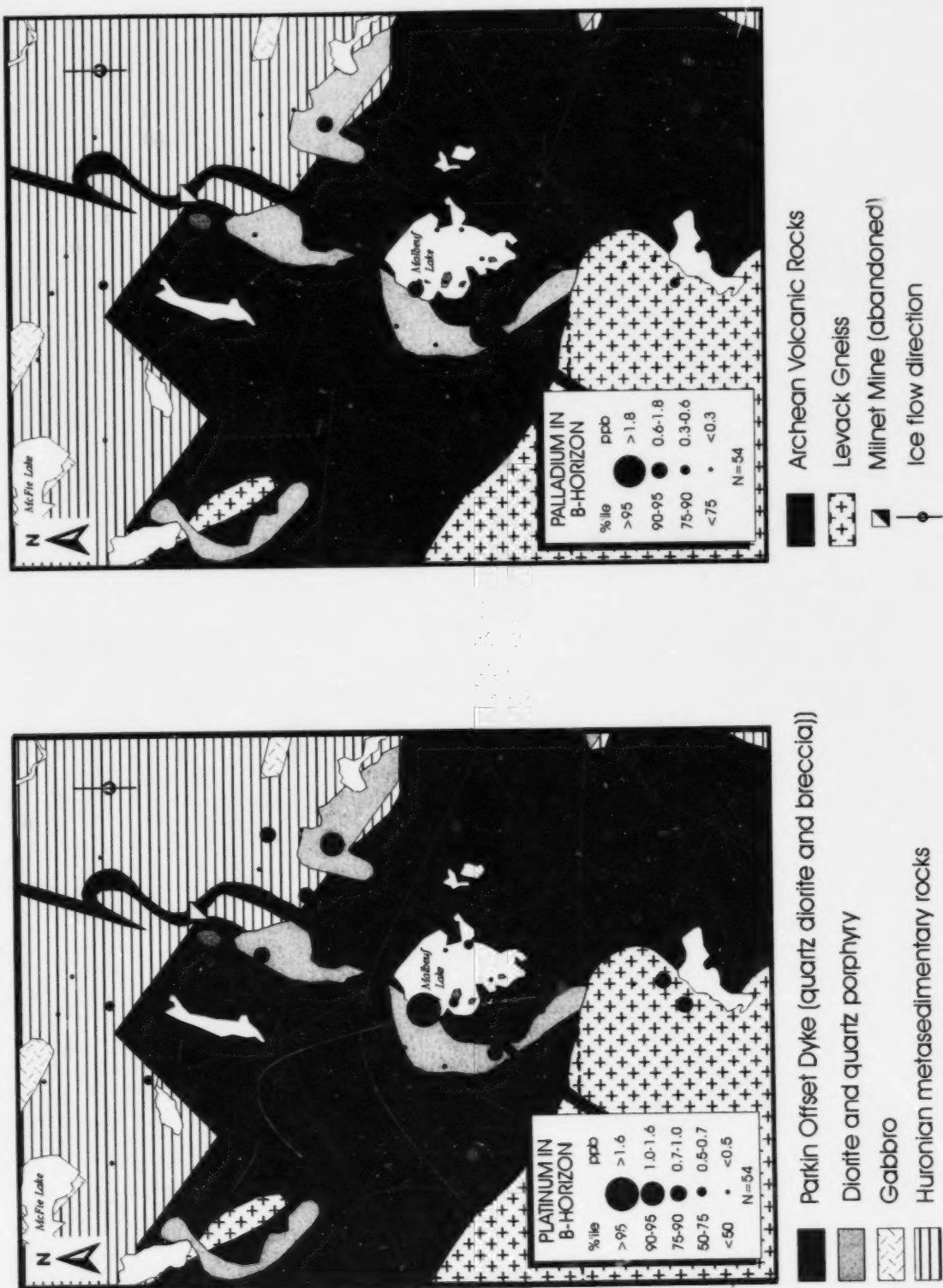


Figure 19. Spatial plots of platinum and palladium in B-horizon till (Parkin Offset orientation survey area).



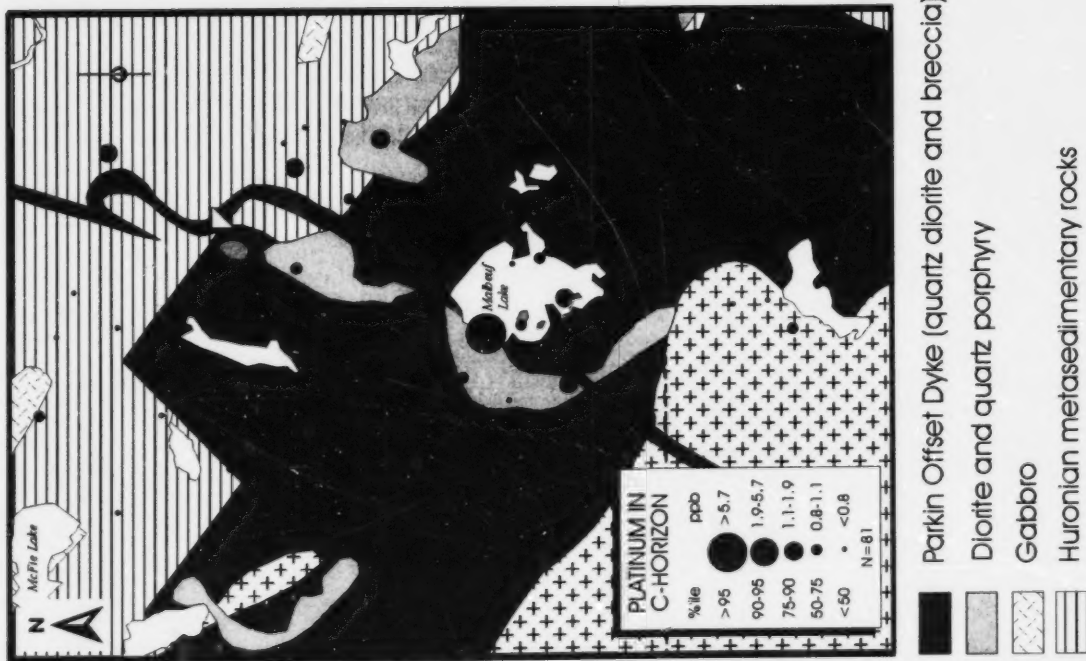
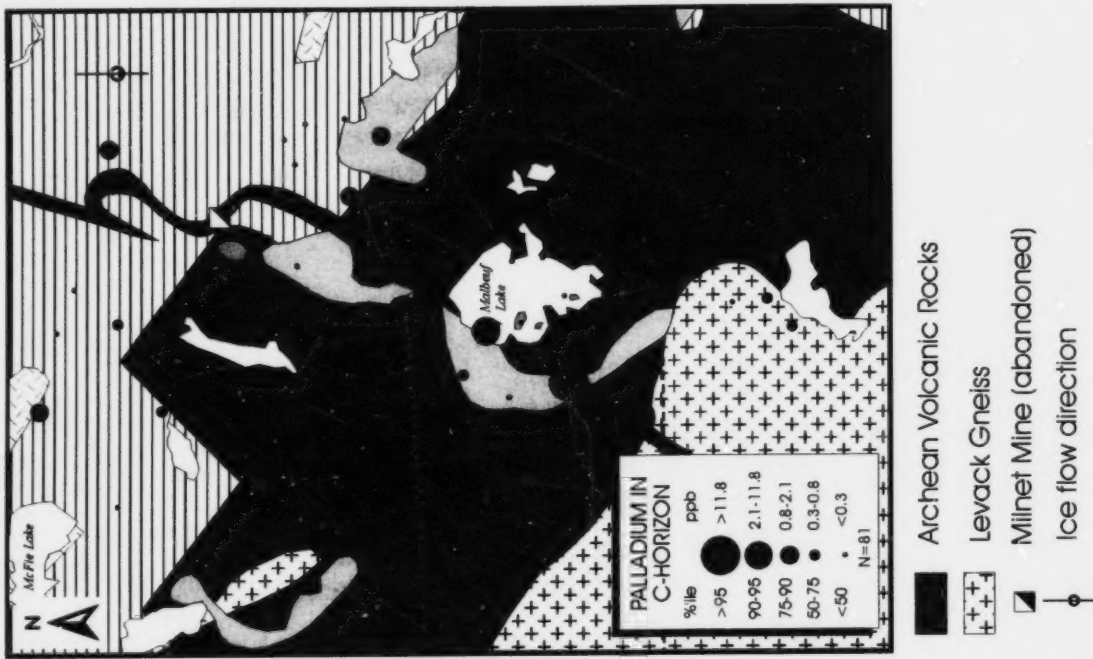


Figure 20. Spatial plots of platinum and palladium in C-horizon till (Parkin Offset orientation survey area).



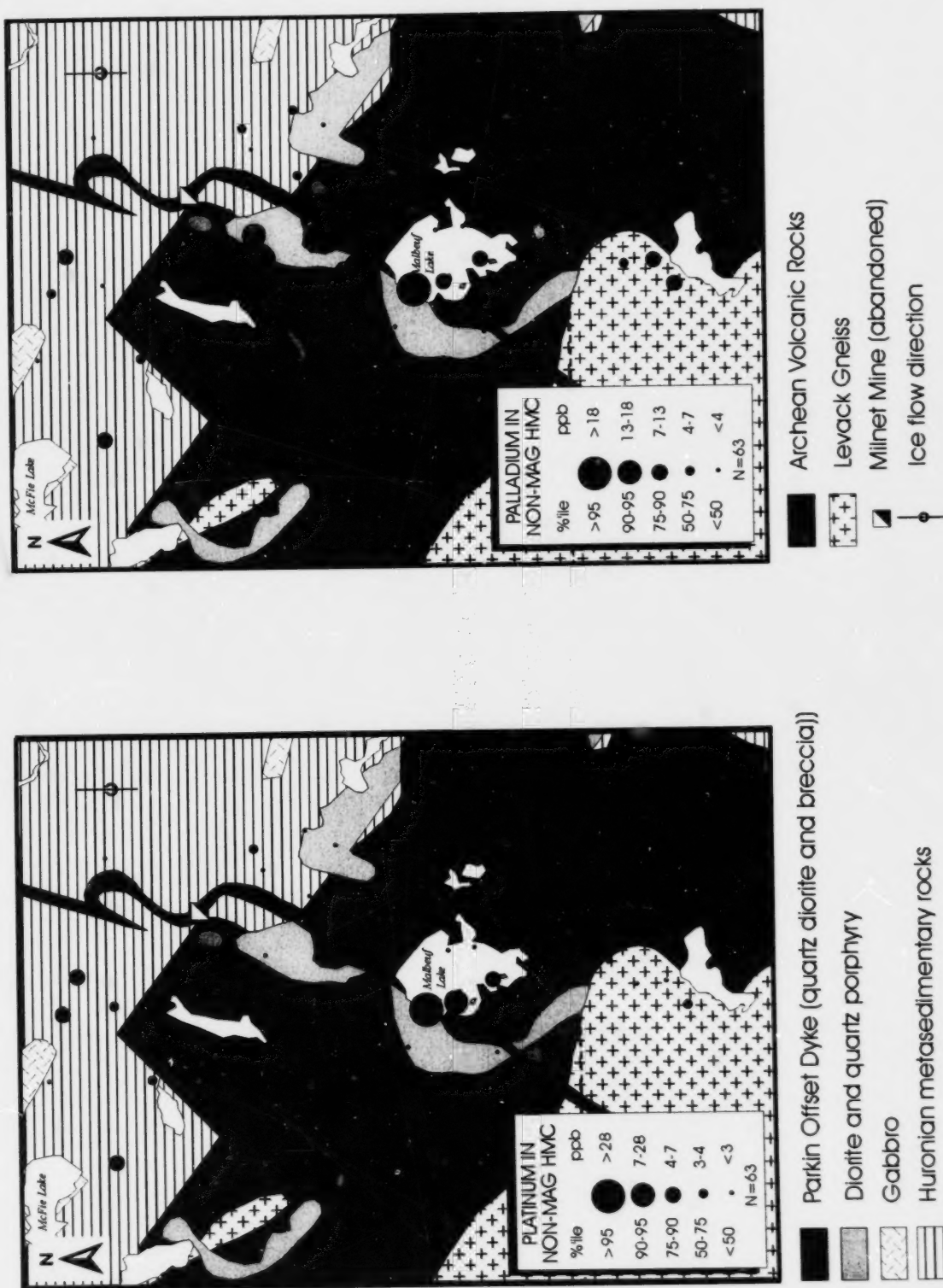


Figure 21. Spatial plots of platinum and palladium in the non-magnetic HMC fraction of C-horizon till (Parkin Offset orientation survey area).

bedrock ridges. Samples were collected at 49 stations within a 20 km<sup>2</sup> area with the highest sampling density obtained from the area surrounding the Barnet, Longvack and Big Levack showings/deposits.

Figures 22 to 25 present the results of Cu, Ni, Pt and Pd analyses performed on humus, B- and C-horizon till and the non-magnetic HMCs of C-horizon till samples collected from the Strathcona Embayment region. Several conclusions can be drawn from the visual inspection of these maps.

1. The geochemical results for humus are random. Contamination from the Strathcona mill and extensive areas of tailings to the south by wind has probably strongly influenced the geochemical response of humus within this area. There are isolated anomalies associated with areas of mineralized Sublayer.
2. The B- and C-horizon and non-magnetic HMC datasets clearly delineate areas of surface mineralization as occur around the Longvack, Big Levack and Barnet showings/deposits as well as within an area of Sublayer at the west-central edge of the area of higher density sampling.
3. The Cu and Ni datasets clearly distinguish contact- from footwall-type mineralization (i.e., footwall deposits are Cu-rich and contact ores are Ni-rich).
4. Down-ice dispersal from mineralization is limited to less than 2 km for Ni and Cu and less than a few hundred metres for Pt and Pd.
5. Background levels of Pt and Pd in the non-magnetic HMC are significantly higher than in the B- and C-horizons. Anomalous values in the B- and C-horizons is in the low ppb range whereas in the non-magnetic HMC, anomalous values climb into the tens to hundreds of ppb.

## Whistle Embayment

Surficial media samples were collected at 8 sites in the immediate vicinity of the INCO Ltd. Whistle Mine which is located at the extreme northeastern corner of the Sudbury basin. The Whistle Mine is situated within the Whistle Embayment which is comprised of a thick zone (400 m wide and 300 m deep) of Sublayer and an Offset dike which protrudes into the footwall Archean migmatites (Lightfoot et al. 1997). The Whistle orebody was mined intermittently until 1997 via an open pit operation. Mineralization occurs within massive, pyrrhotite-rich sulphide ore typically grading 2 to 3 wt.% Ni with >0.2 wt.% Cu and <500 ppb Pt+Pd (Lightfoot et al. 1997). The low Cu and PGE content of the orebody is typical of contact-type mineralization.

The mine area is characterized as a bedrock-dominated terrain where till cover is extremely thin and discontinuous. The search for suitable C-horizon till within this area proved to be very difficult. Where present, the till contained excessive amounts of stratified material making it unsuitable for sampling. The ore body is situated on the crest of a bedrock upland where till cover is minimal to non-existent. Thin soils are, however, widely distributed within this area and are primarily developed on till.

Figures 26 to 29 present the results of Cu, Ni, Pt and Pd analyses performed on humus, B- and C-horizon till and the non-magnetic HMCs of C-horizon till samples collected from the Whistle Embayment region. Several conclusions can be drawn from the visual inspection of these maps.

1. The geochemical results for humus are random. Contamination from local smelters is likely responsible for this pattern.
2. The mineralized portion of the Whistle Embayment is clearly delineated by the Ni, Cu and PGE datasets. Ni and Cu anomalies are restricted to areas proximal to the main Whistle deposit. Elevated to anomalous Pt and Pd values occur at more distal settings as well.
3. Consistent responses have not been obtained between media at sample sites (i.e., a site with anomalous C-horizon and HMC responses does not necessarily contain anomalous B-horizon responses. The Pt datasets highlighted in Figure 28 clearly display this inconsistency).

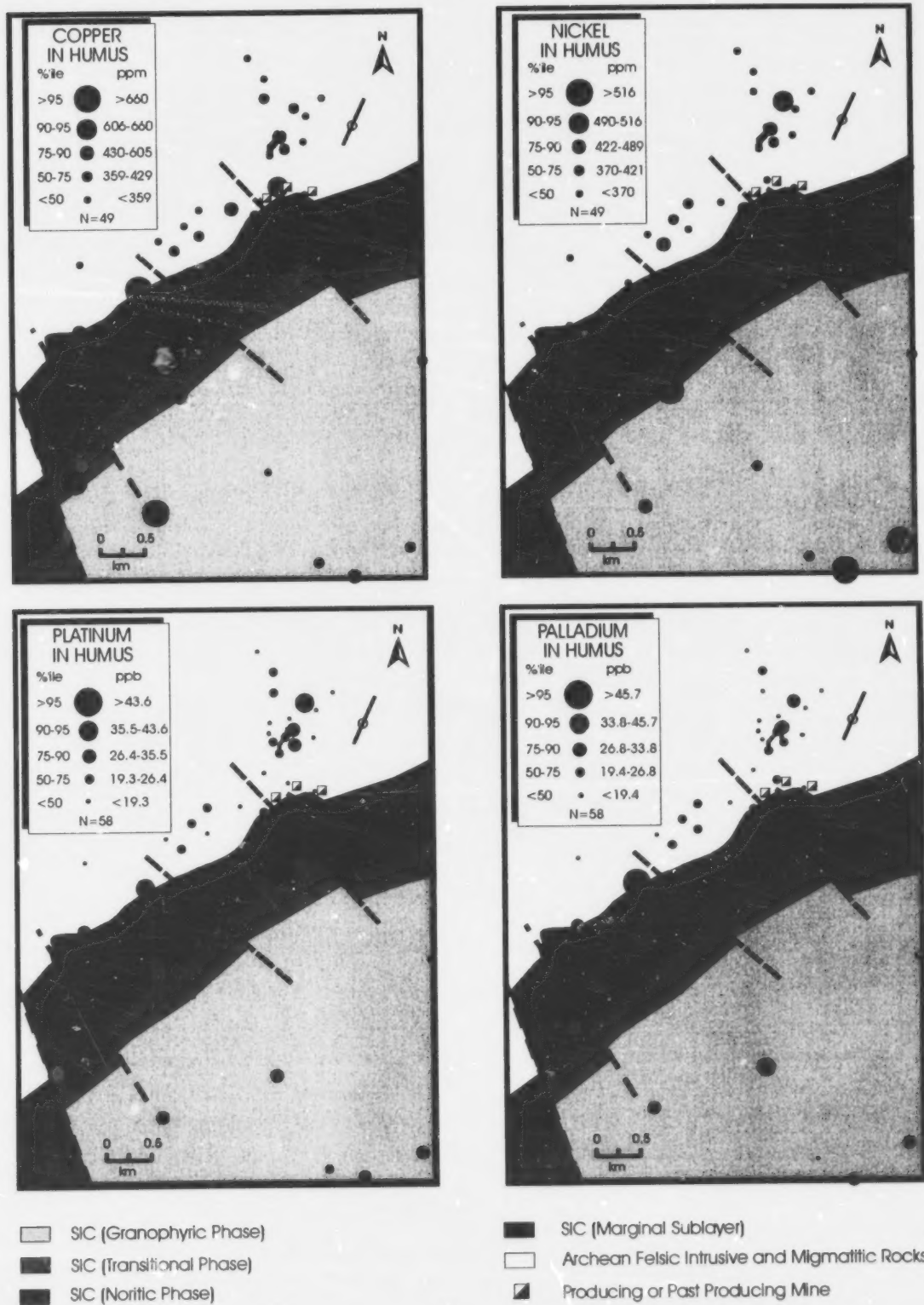
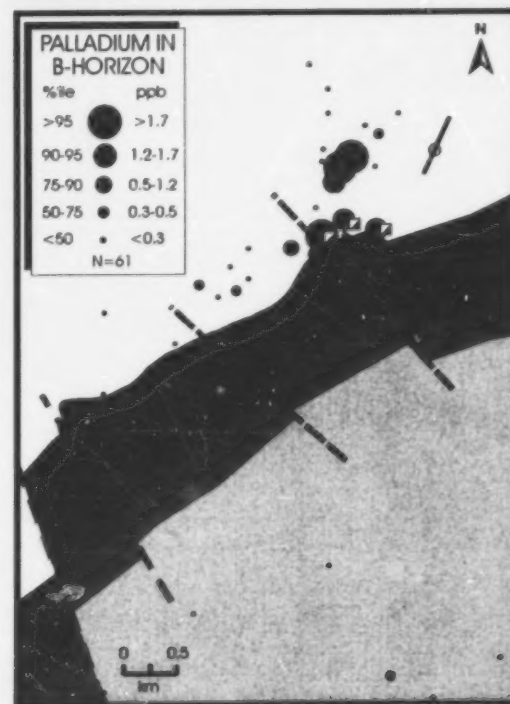
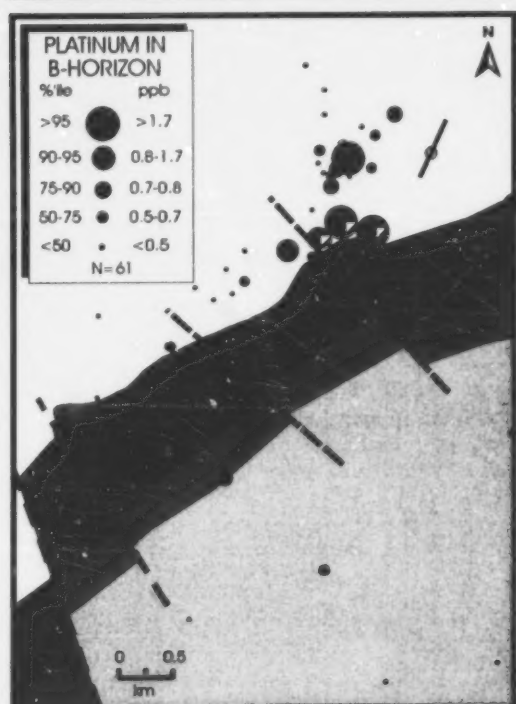
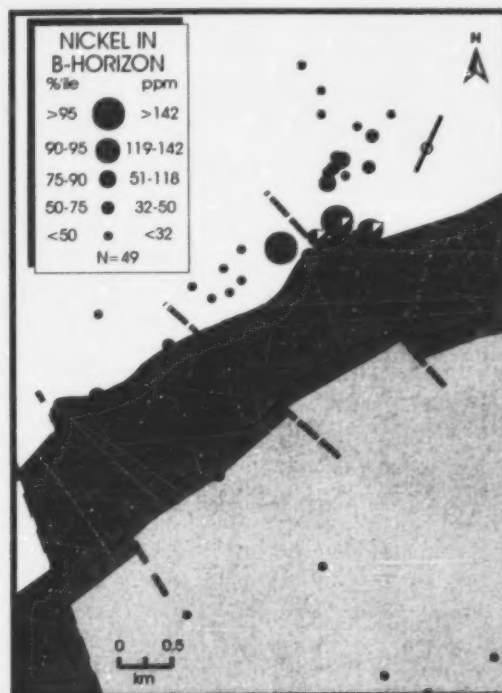
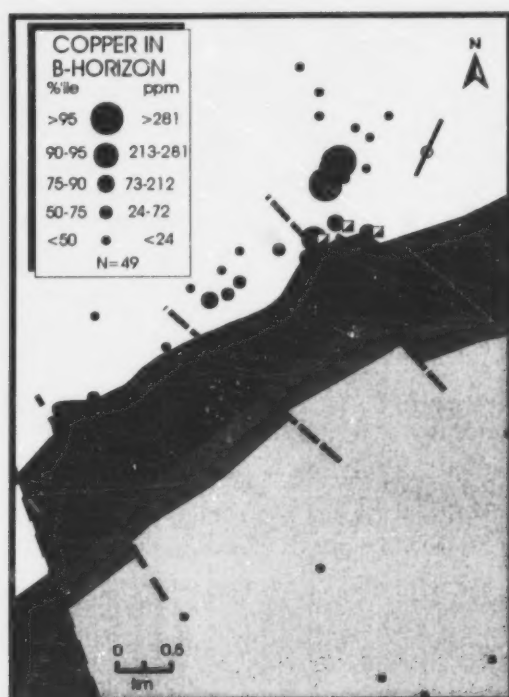


Figure 22. Spatial plots of copper, nickel, platinum and palladium in humus (Strathcona Embayment orientation survey area).





SIC (Granophytic Phase)  
 SIC (Transitional Phase)  
 SIC (Noritic Phase)

SIC (Marginal Sublayer)  
 Archean Felsic Intrusive and Migmatitic Rocks  
 Producing or Past Producing Mine

Figure 23. Spatial plots of copper, nickel, platinum and palladium in B-horizon till (Strathcona Embayment orientation survey area).



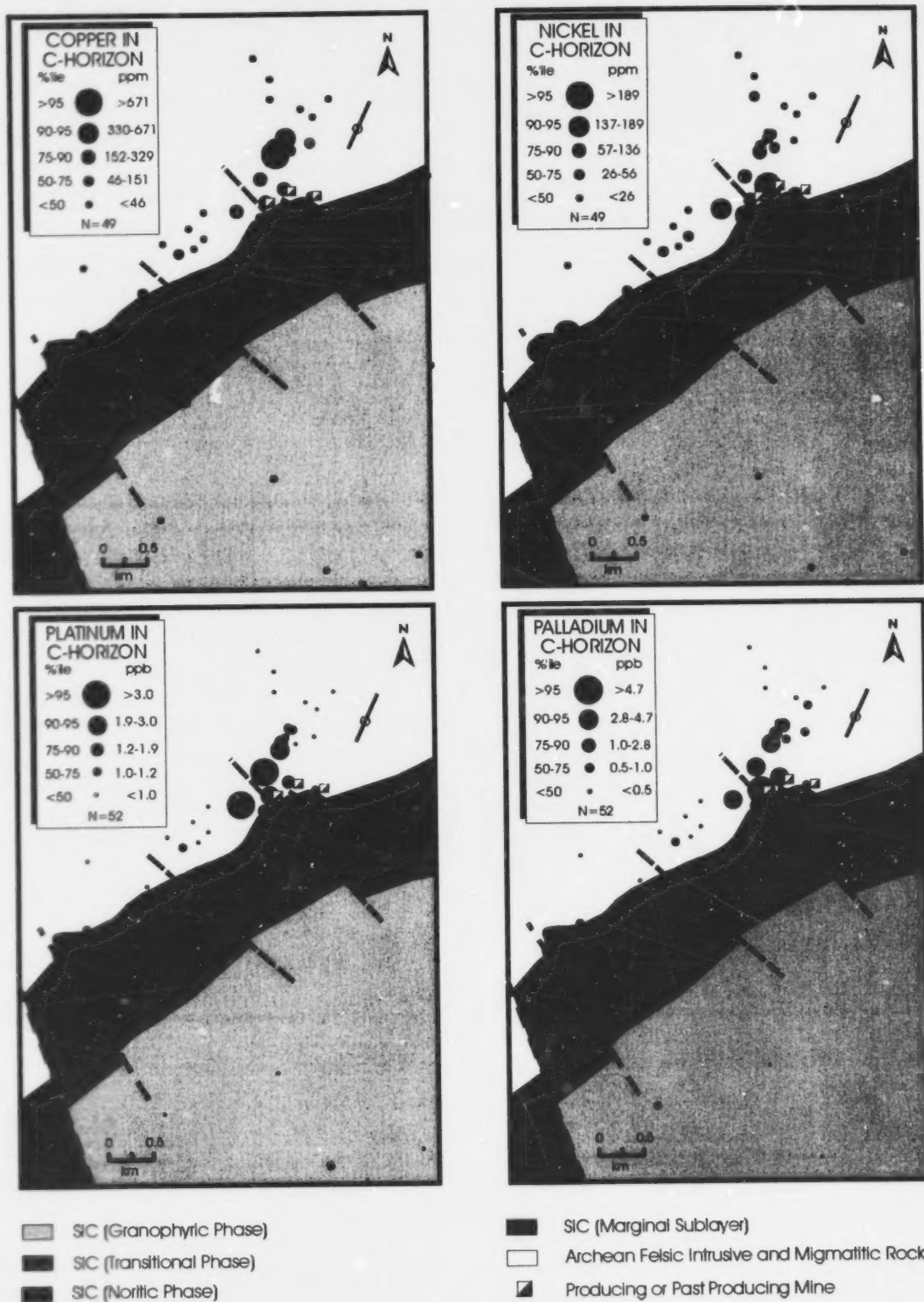
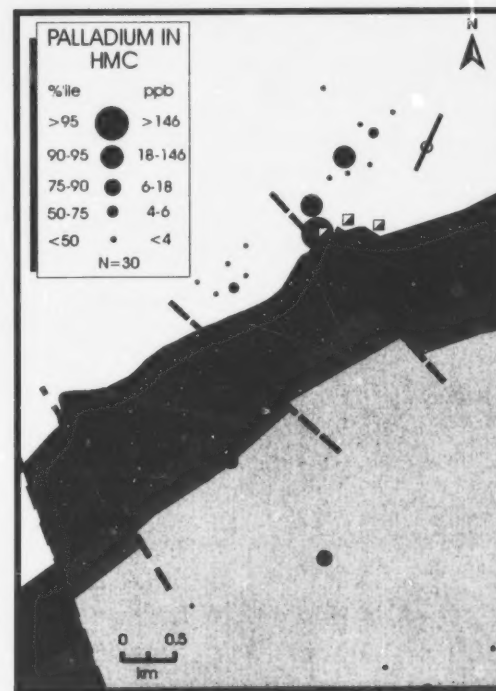
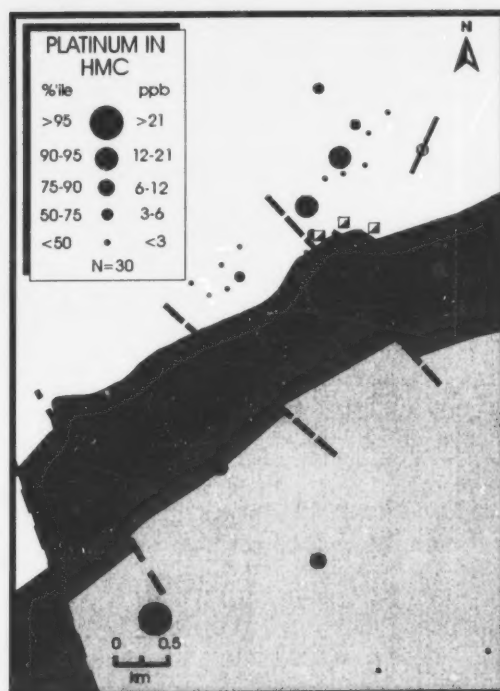
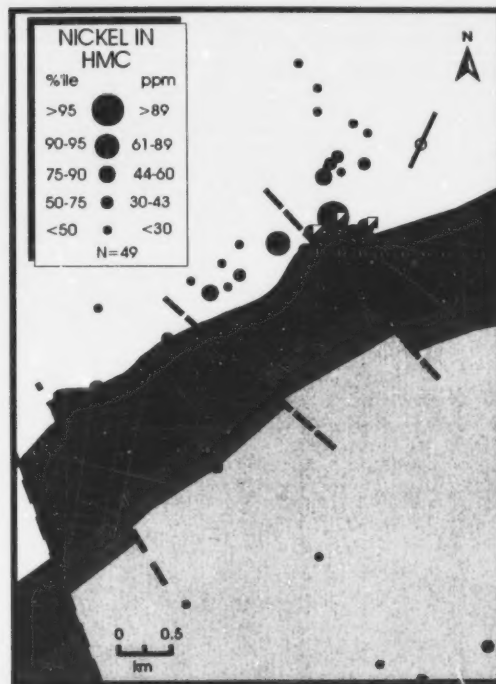
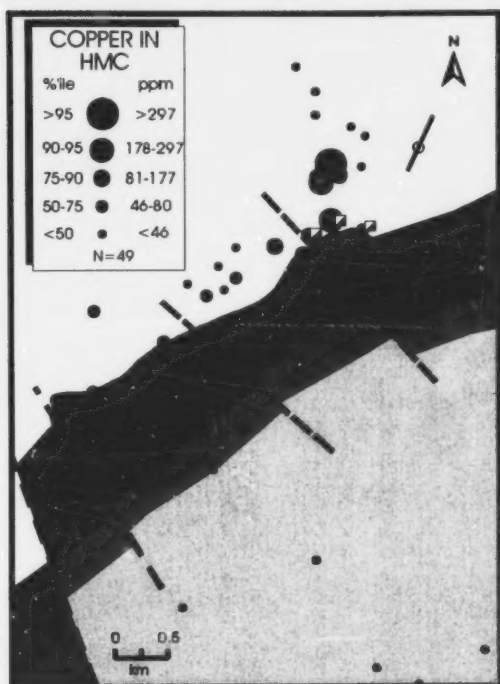


Figure 24. Spatial plots of copper, nickel, platinum and palladium in C-horizon till (Strathcona Embayment orientation survey area).



SIC (Granophytic Phase)  
 SIC (Transitional Phase)  
 SIC (Noritic Phase)

SIC (Marginal Sublayer)  
 Archean Felsic Intrusive and Migmatitic Rocks  
 Producing or Past Producing Mine

**Figure 25.** Spatial plots of copper, nickel, platinum and palladium in the non-magnetic HMC fraction of C-horizon till (Strathcona Embayment orientation survey area).

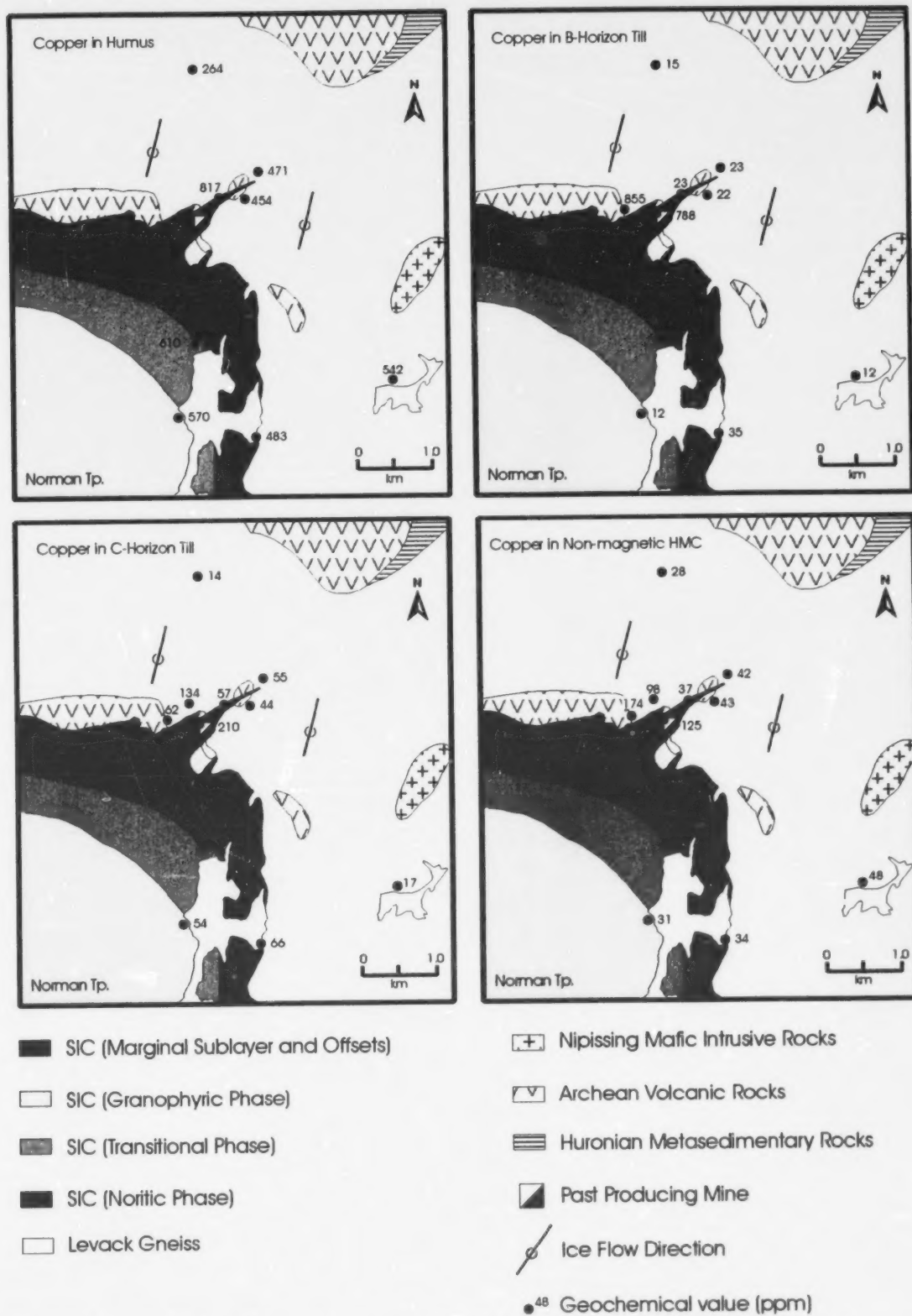


Figure 26. Spatial plots of copper in humus, B-horizon till, C-horizon till and the non-magnetic HMC fraction of C-horizon till (Whistle Embayment orientation survey area).

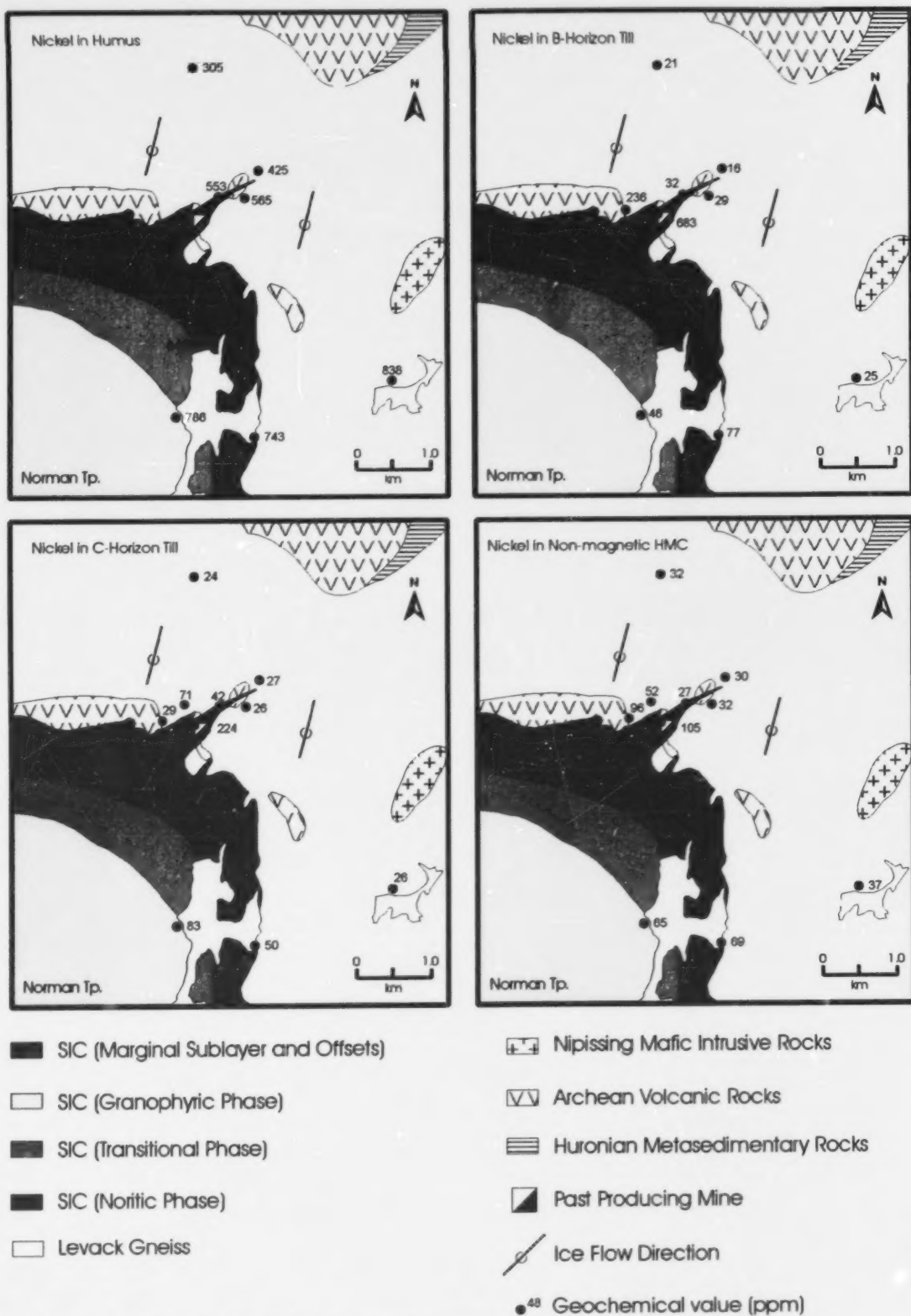


**Figure 27.** Spatial plots of nickel in humus, B-horizon till, C-horizon till and the non-magnetic HMC fraction of C-horizon till (Whistle Embayment orientation survey area).

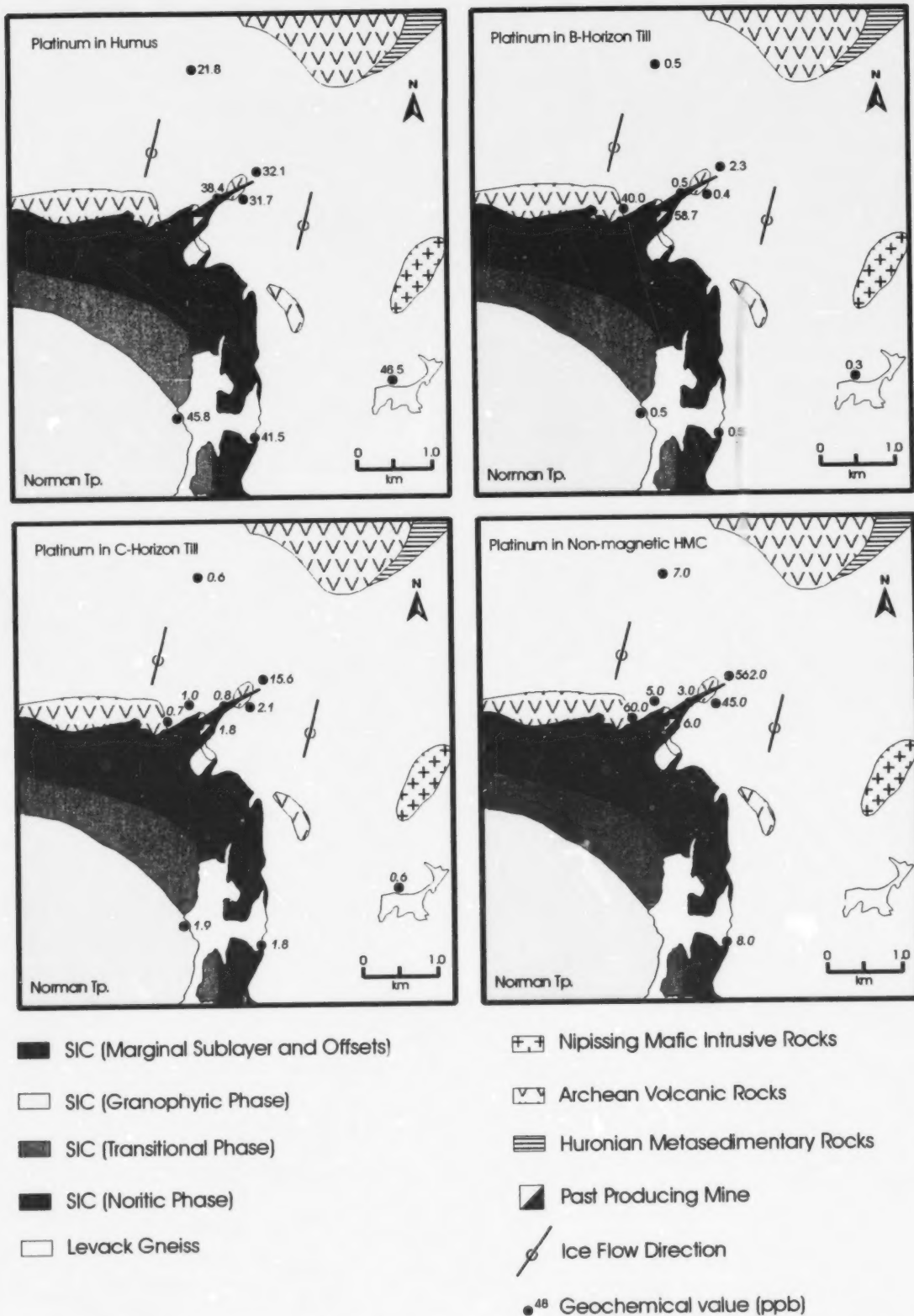


Figure 28. Spatial plots of platinum in humus, B-horizon till, C-horizon till and the non-magnetic HMC fraction of C-horizon till (Whistle Embayment orientation survey area).



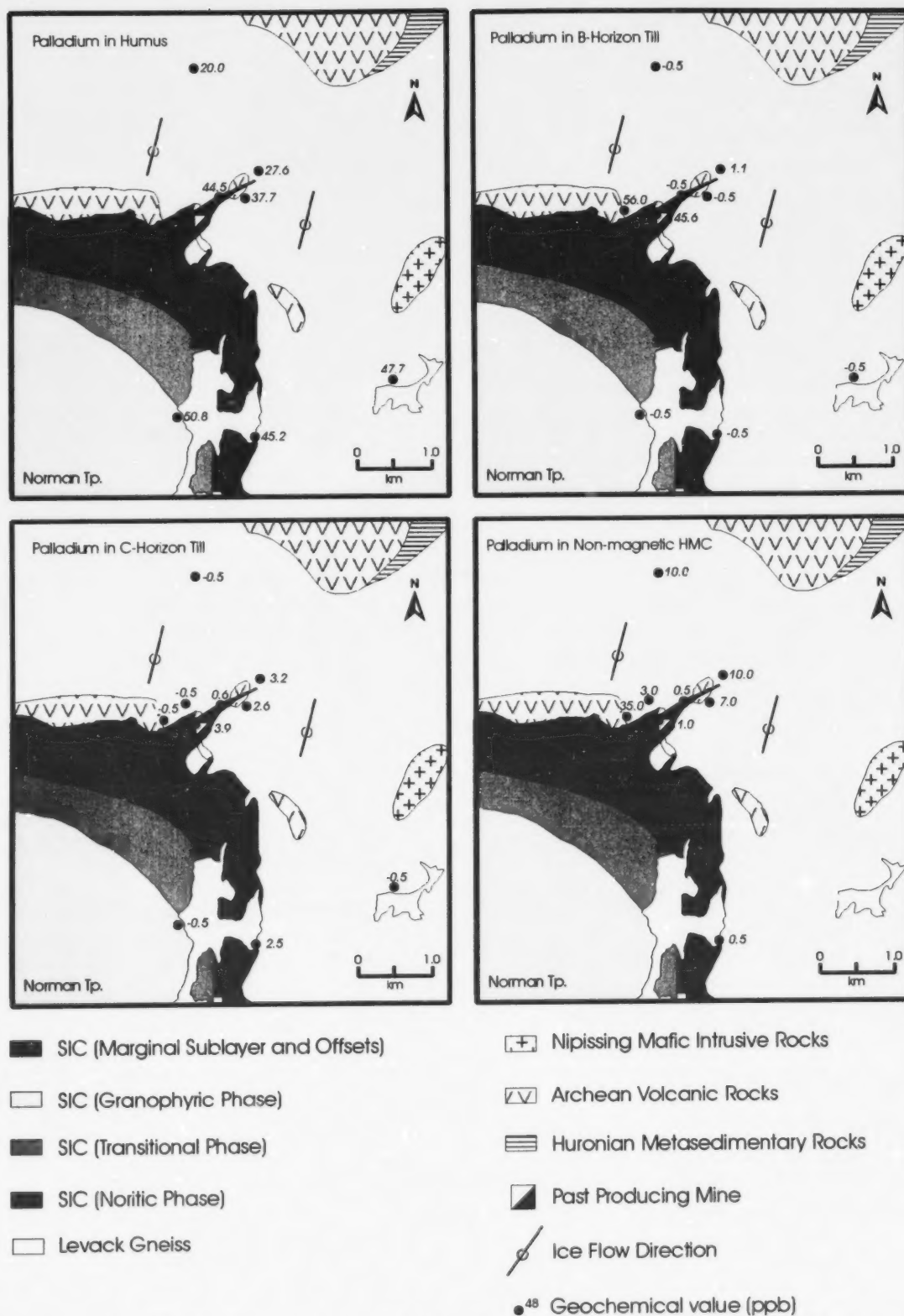


**Figure 29.** Spatial plots of palladium in humus, B-horizon till, C-horizon till and the non-magnetic HMC fraction of C-horizon till (Whistle Embayment orientation survey area).

4. Despite containing low PGE values, soils in the Whistle Embayment area returned some of the highest Pt and Pd values of the entire survey area. Notable Pt values include: 126.6 ppb in B-horizon till; 15.6 ppb in C-horizon till; and 562.0 ppb in the non-magnetic HMC. Notable Pd values include: 98.6 ppb in B-horizon till; 13.3 ppb in C-horizon till; and 35.0 ppb in the non-magnetic HMC. Some of these anomalous values were obtained from samples collected either up-ice or adjacent to the main deposit. These anomalous values may indicate the potential for precious metal-rich footwall-type mineralization.

## **Victor/Nickel Rim Mines Area**

Higher-density sampling was also undertaken along the east rim of the Sudbury basin within the area encompassing the Victor and Nickel Rim mines. These mines have not been in operation since the early 1960s. Information regarding the grade and character of mineralization is limited. Mineralization at the Victor Mine is of the contact-type and occurs within quartz diorite and quartz diorite breccia. The ore consists of pyrrhotite, pentlandite and chalcopryite and occurs as massive sulphides, breccia sulphides and disseminated sulphides grading 1.41% Cu, 3.0% Ni with low concentrations of PGEs (B. Martindale, INCO Exploration, personal communication). Mineralization at the Nickel Rim deposit to the southeast occurs in a similar setting (Thomson 1961). Sulphides, which consist of pyrrhotite, pentlandite, chalcopryite and lesser amounts of pyrite, occur in a series of irregular, disconnected bodies. The surface expression of mineralization extends for well over 1.5 km along the SIC/footwall contact. Ores with an average grade ranging between 1.58 and 3.25% Ni and 0.59 and 0.64% Cu were extracted from the deposit between 1945 and 1958 (Dressler 1982).

A sample spacing of approximately 200 m was achieved in the immediate vicinity of the Victor Mine. Few samples could be collected around the Nickel Rim Mine due to excessive ground disturbance. Samples were collected, however, to the southwest over the SIC as well as to the northeast within Levack gneisses to establish background concentrations of metals for this region. The area is characterized as a bedrock-dominated terrain where till occurs as a thin, discontinuous veneer. The crown pillar of the Victor deposit is situated at the crest of a prominent bedrock knob and was therefore probably easily eroded by the advancing glacier. The Nickel Rim deposits, on the other hand, are situated within a trough between prominent bedrock uplands. Mineralized rock was less likely to be eroded and dispersed long distances from this setting.

Figures 30 to 33 present the results of Cu and Ni analyses performed on humus, B- and C-horizon till and non-magnetic HMCs of C-horizon till samples collected from the Victor/Nickel Rim mines areas. Several conclusions can be drawn from the visual inspection of these maps.

1. The geochemical results for humus display a poor correlation with the position of known mineralization. This area is strongly affected by local smelting activity. The Falconbridge and Coniston smelters are located approximately 12 and 21 km, respectively south of the Victor/Nickel Rim mines area.
2. The B- and C-horizon datasets clearly delineate the position of the Victor orebody. Anomalies south and west of Capre Lake are likely attributed to the southwesterly dispersal of mineralized Sublayer from the northeast shore of the lake.
3. The non-magnetic HMC fails to delineate the position of the Victor and Nickel Rim ore bodies. It is unclear whether Ni anomalies situated less than a kilometre to the southwest of these deposits are attributed to the glacial dispersal of mineralized Sublayer. Anomalous Cu responses were obtained from a couple of samples collected near the SIC/Footwall contact approximately 2 to 3 km to the southeast. The significance of these responses are not well understood and should be investigated further.

## **Ministic Offset**

A slightly higher density of samples were collected from the area surrounding the Ministic Offset in Cascaden Township. The Ministic Offset has been traced northwesterly for approximately 2 km from the

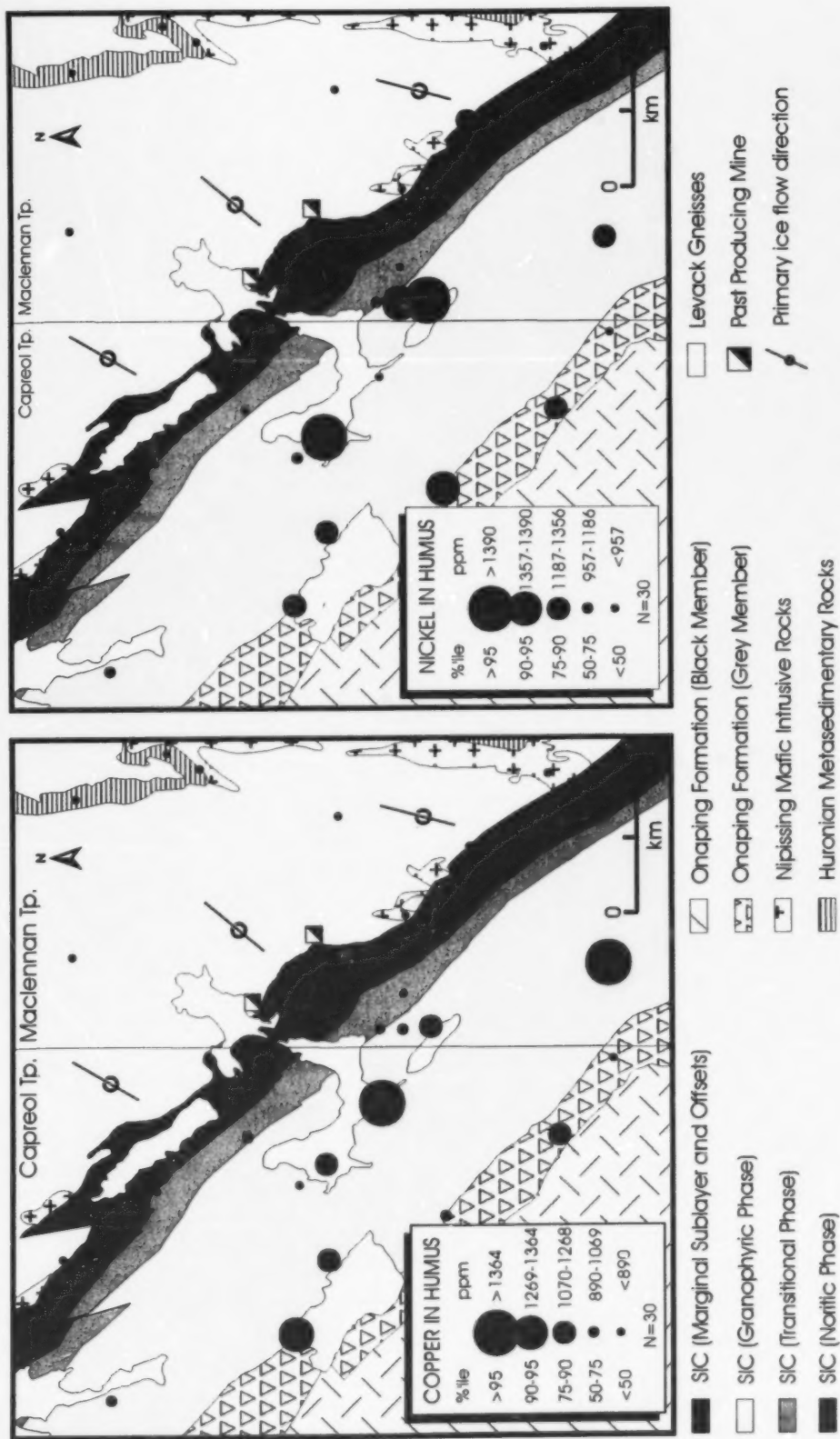


Figure 30. Spatial plots of copper and nickel in humus (Victor/Nickel Rim mines orientation survey area).

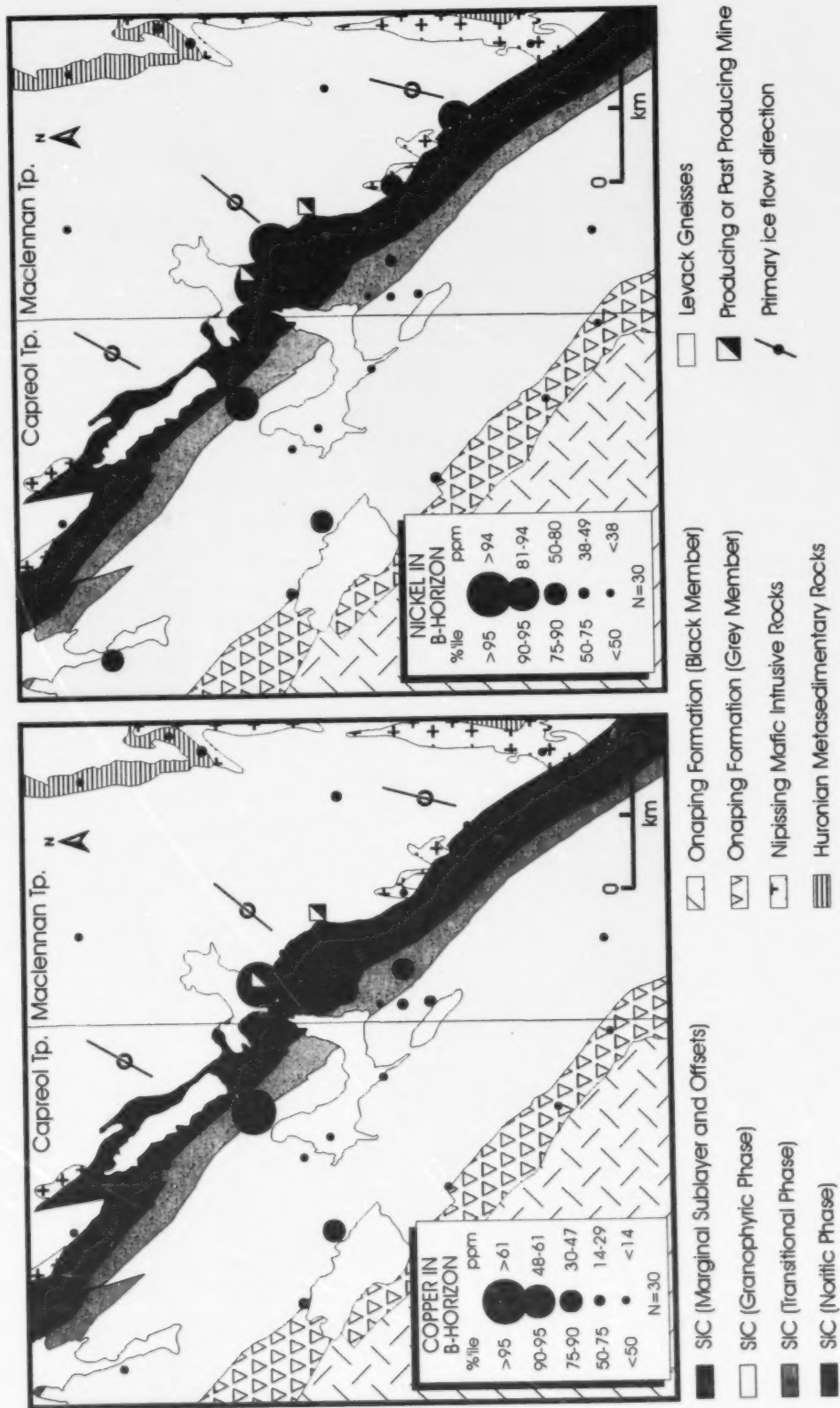


Figure 31. Spatial plots of copper and nickel in B-horizon till (Victor/Nickel Rim mines orientation survey area).

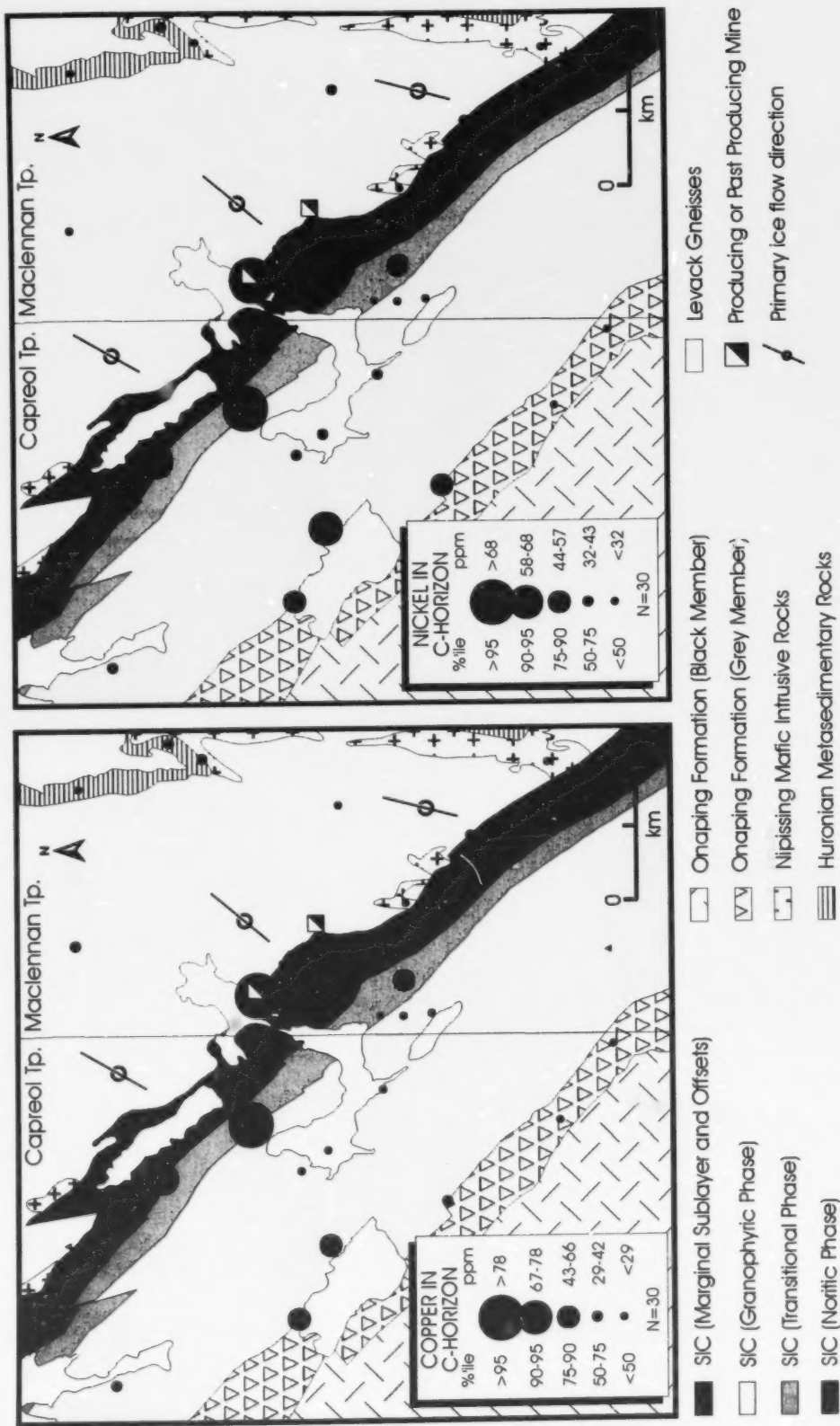


Figure 32. Spatial plots of copper and nickel in C-horizon till (Victor/Nickel Rim mines orientation survey area).



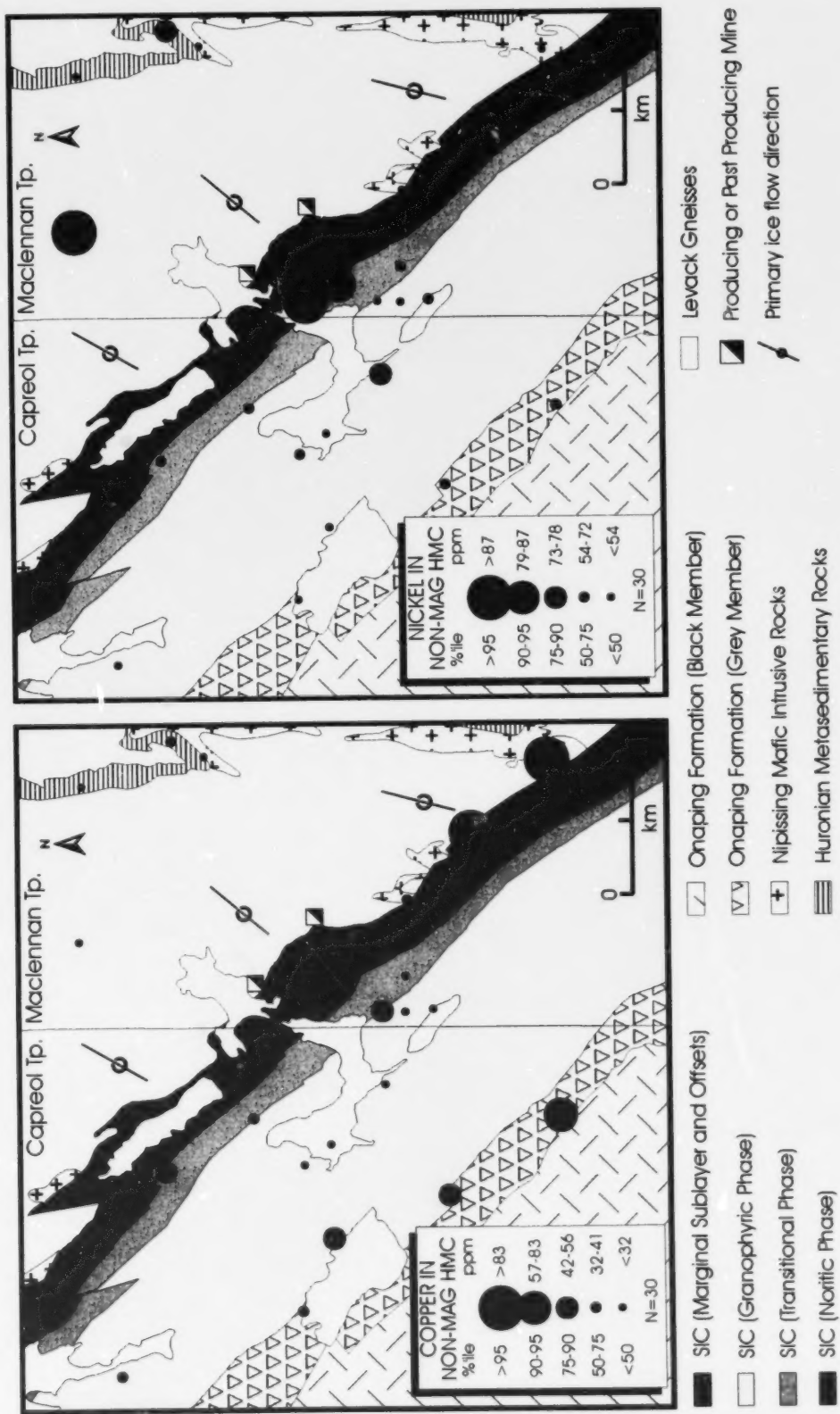


Figure 33. Spatial plots of copper and nickel in the non-magnetic HMC fraction of C-horizon till (Victor/Nickel Rim mines orientation survey area).

SIC/footwall contact and consists primarily of quartz diorite, locally containing inclusions of melanorite and pyroxenite. Sublayer and Footwall breccia fill a small embayment structure at the proximal end of the dike (Grant and Bite 1984). Disseminated sulphides occur locally within the offset (Lightfoot et al. 1997). Little information is available regarding the character and grade of mineralization. Samples were collected from 12 sites within an 8 km<sup>2</sup> area surrounding the offset dike. Drift cover around the shores of Ministic Lake is thin and discontinuous. Thick deposits of glaciofluvial sands and gravels are common, however, within the Mosquito Lake area. They conceal much of the bedrock surface and prevent easy access to till.

The position of the Ministic Offset is clearly delineated by the B- and C-horizon datasets and marginally indicated by slightly elevated Ni and Pt values in humus at one site. The B-horizon datasets contained 5 samples with elevated to anomalous Ni values and 3 samples with elevated to anomalous Cu values. Pt and Pd values occur at background levels. The C-horizon datasets contained 4 samples with elevated to anomalous Ni and Cu values, 3 samples with elevated to anomalous Pt values and 2 samples with anomalous Pd values.

## Foy Offset

The Foy Offset Dike has been traced for approximately 28 km from the main mass of the SIC in Bowell Township into Foy and Tyrone townships to the west and northwest, respectively. The abandoned Nickel Offset Mine occurs along the offset in central Foy Township. At the mine site, a relatively, sulphide- and xenolith-poor marginal zone of quartz diorite encloses a core of sulphide- and xenolith-rich quartz diorite. Pods of massive sulphide up to 60 m long and grading 3.5 wt.% Cu, 4.3 wt.% Ni and 6.2 ppm combined PGEs were mined from the deposit (Card and Meyn 1969). Samples were collected from 10 sites within a 2 to 3 km<sup>2</sup> area surrounding the mine site. Drift cover within this region is minimal.

Humus samples collected in the vicinity of the Nickel Offset Mine contained background levels of Ni, Cu, Pt and Pd. The B- and C-horizon datasets weakly indicate the presence of mineralization within this area. Three B-horizon samples contain elevated to anomalous Cu and Pt values. Three C-horizon samples contain elevated to anomalous Cu values and 2 samples contain elevated to anomalous Ni values. Higher density sampling closer to mineralization may be required to more clearly delineate the deposit.

Several conclusions can be drawn from the aforementioned case studies.

1. Anthropogenic sources of metals from local smelting, milling and tailings facilities in the Sudbury region have contaminated humus to the point where it is not a viable sampling medium for mineral exploration programs.
2. The geochemistry of -63 µm fraction B- and C-horizon till displays an excellent spatial association with known Cu-Ni-PGE mineralization. The less altered C-horizon exhibits a slightly better response.
3. The non-magnetic HMC shows higher contrast geochemical anomalies which are, in most cases, closely associated with known mineralization. Numerous spurious responses were also observed in the non-magnetic HMC datasets. Heavy mineral geochemistry is not a cost-effective method for exploring for Cu-Ni PGE mineralization in the Sudbury north and east ranges. The mineralogy of the HMC may, on the other hand, prove to be an excellent exploration tool.
4. Dispersal trains of Pt and Pd originating from known mineralization tend to be short (less than a few hundred metres) whereas the corresponding Ni and Cu trains are longer (500 to 2000 m long). Dispersal train geometry is dictated by the orientation of the mineralized horizon with respect to regional ice flow.
5. The strength of the geochemical response of B- and C-horizon till in the vicinity of Ni-Cu-PGE mineralization is dependent upon the exposed surface area of mineralization and its position with respect to bedrock topography and regional ice flow.

## ULTRA-HIGH DENSITY SAMPLING OVER MINERALIZATION

### Barnet Property

The Barnet property is located approximately 1.5 km northeast of the Strathcona and Coleman mine headframes and less than 500 m from the ore-bearing Footwall Breccia of the mined-out Longvack open pits. Mineralization occurs as Cu-rich veins within Archean footwall gneisses and Sudbury Breccia. The deposit has an average grade of 0.6% Ni and 4.0% Cu. Combined PGE values average less than 1 ppm but in places exceed 10 ppm (Coker et al. 1991).

Humus, B- and C-horizon till samples were collected at 20 m intervals along a northeast-trending trench which follows the mineralized zone for approximately 300 m. Figure 34 highlights the position of the trench with respect to the regional sampling grid as well as the sample locations along the trench with respect to topography and surface mineralization. Geochemical profiles for humus, B- and C-horizon till are presented immediately above the topographic information.

There is a general trend of increasing Cu-Ni-Au-Pt-Pd in humus towards the north end of the trench. The highest values were obtained over the northern zone of sulphide mineralization as well as to the north at the base of a steep decline. The B-horizon datasets show spikes in Cu-Ni-Au-Pt-Pd immediately over and/or down-ice from the northern sulphide zone. The southern area of sulphides is indicated by a single B-horizon sample that contains elevated Au. The C-horizon datasets display elevated Cu, Au and Pd over and/or immediately up-ice from the northern sulphide zone and Cu, Ni and Pd immediately down-ice from the southern zone of sulphides. This example clearly demonstrates the complexity of response over and adjacent to known sulphide mineralization. Elevated humus values were not obtained from samples collected immediately over mineralization as was expected. Topography appears to have affected the geochemical response to some extent, possibly resulting in hydromorphic anomalies in low-lying areas surrounding mineralization.

### Parkin Offset

Detailed profile sampling was undertaken at 5 m intervals along a trench located approximately 150 m north of the Parkin-Norman township line. The trench is one of several opened by Falconbridge Exploration Limited in 1990 as part of their exploration efforts on the Parkin Offset Dike (Northbridge Property). Sulphide mineralization has been recognized over a strike length of 300 m and occurs as pods and stringers of massive to disseminated pyrrhotite, chalcopyrite and pyrite within quartz diorite and quartz diorite breccia. Although ore grade intersections were not obtained from the sampled trench, encouraging results were obtained from other trenches on the property (unpublished report, Falconbridge Exploration Limited).

Till samples were collected vertically at 20 cm intervals through the B- and C-horizons to the bedrock surface. Results of the detailed sampling are presented in Figure 35. Pods and stringers of sulphides occur along the entire length of the trench but are most concentrated at the base of site 165. The uppermost sample at each site represents the B-horizon or sediment collected as "soil" in the mineral exploration sector. At this site, these samples are almost always depleted in metals with respect to the underlying material and yield regionally insignificant geochemical signatures. A soil (B-horizon) sampling survey would most likely have failed to identify mineralization. Additional case histories are required in order to determine whether the B-horizon shows similar depleted signatures over other Ni-Cu-PGE mineralized sites.

C-horizon samples collected over and down-ice from mineralization at site 165 generally returned elevated to anomalous concentrations of Cu and Ni. Anomalous Pt and Pd values were also obtained from the lowest till sample at site 168. Samples collected from sites 159, 160 and 161 at the northwest end of

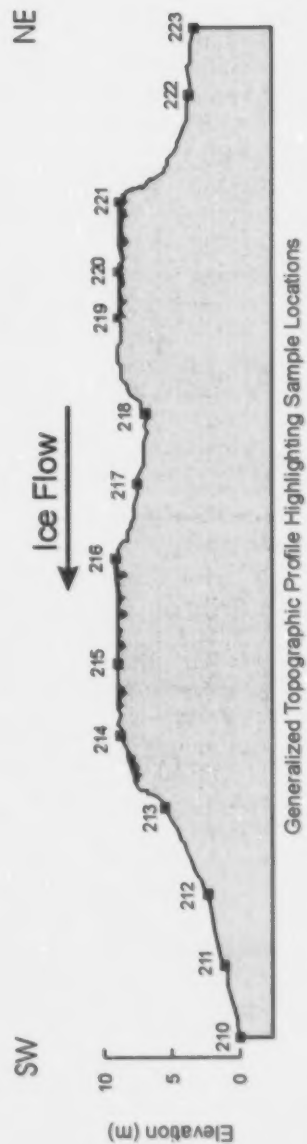
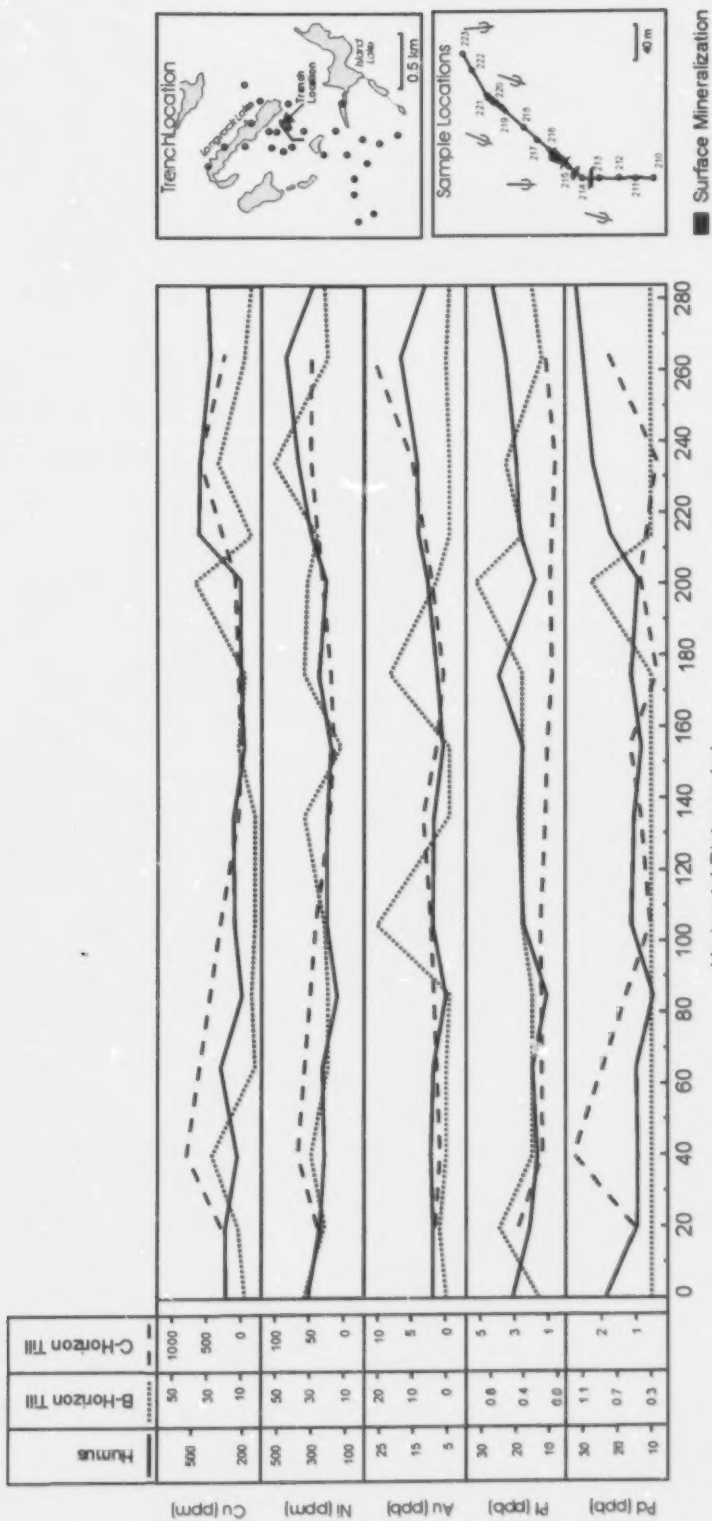


Figure 34. Geochemical results of ultra-high density sampling over the Barnet property (Levack Township).

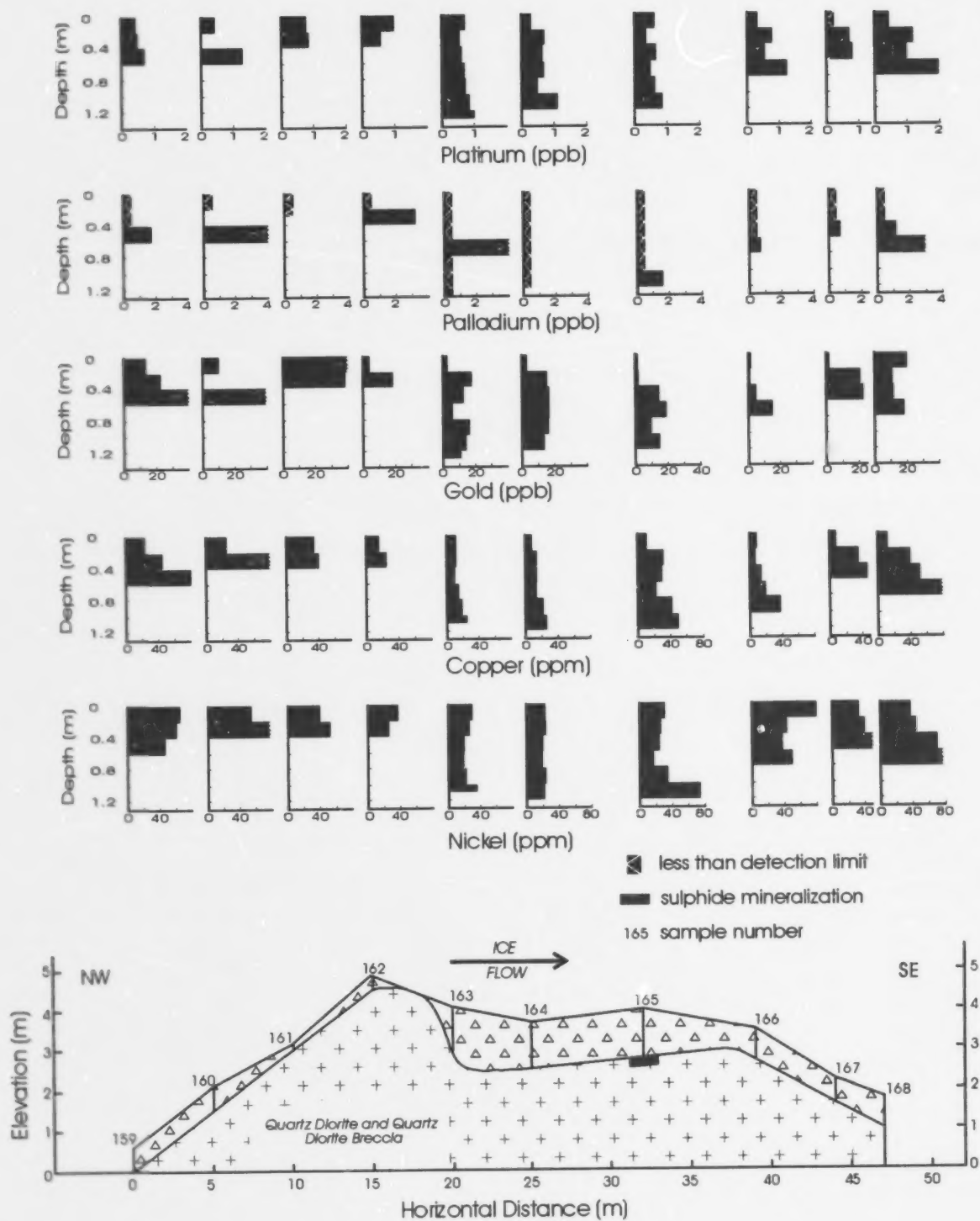


Figure 35. Geochemical results of ultra-high density profile sampling over the Parkin Offset dike (Parkin Township).



the trench also contained elevated to anomalous concentrations of Cu, Ni and Au indicating the probable occurrence of additional sulphide mineralization in the up-ice direction.

The general erratic nature of the geochemical responses illustrated in Figure 35 should be noted. Pd values of 6.1, 24.0 and 17.1 ppb are regionally significant but not consistent from site to site and horizon to horizon. Only a small proportion of the Ni, Cu and Au responses are regionally anomalous. In most cases, the regionally anomalous samples were collected from the till/bedrock interface. With a hypothetical sample spacing of 20 to 25 m, as is common practice in industry, mineralization would likely have been detected by sampling till at the bedrock interface. The chances of detecting mineralization of this type decreases with increased sample spacing.

## Regional Dispersal Patterns

In addition to providing information on the background concentrations of pebbles, minerals and elements in the surficial environment, the regional compositional datasets have provided valuable information on glacial dispersal.

### PEBBLE LITHOLOGIES IN TILL

Proportional dot plots highlighting the percentages of pebble lithologies (5–40 mm diameter) recovered from C-horizon till were prepared for 7 lithologic groups. These include: 1) equigranular felsic-intermediate intrusive rocks; 2) non-equigranular felsic-intermediate intrusive rocks; 3) coarse-grained mafic intrusive rocks; 4) fine-grained mafic intrusive rocks; 5) mafic extrusive rocks; 6) felsic-intermediate extrusive rocks; and 7) metasedimentary rocks. The equigranular felsic-intermediate intrusive and coarse-grained mafic intrusive pebbles are largely derived from relatively unmetamorphosed felsic to mafic phases of the SIC (granophyric, transitional and noritic phases). Some of the coarse-grained mafic intrusive pebbles may be derived from Nipissing diabase as well. Fine-grained mafic intrusive pebbles are primarily derived from Nipissing diabase and late northwest-trending diabase dikes. A proportion of the total may also be derived from the noritic phase of the SIC. The non-equigranular felsic-intermediate intrusive pebbles are likely derived from metamorphosed intrusive rocks of the Levack Gneissic Complex. Mafic and felsic-intermediate extrusive pebbles are probably derived from narrow Archean greenstone belts that occur northwest of (Benny belt) and at the northeast corner of the study area. Metasedimentary pebbles consist primarily of Proterozoic-aged conglomerates, arenites and argillites/mudstones (Huronian Supergroup) and are likely derived from the Cobalt Embayment northeast of the Sudbury structure as well as from outliers northwest of the Sudbury structure in the vicinity of the Benny belt.

The patterns depicted by the equigranular felsic-intermediate intrusive pebbles (Figure 36) closely mimic the distribution of granophyric and transitional phases of the SIC. Till samples collected over granophyric and transitional phases of the SIC generally contain greater than 40% of this component. Levels between 10 and 41% persist up to 5 km in the down-ice direction. Coarse-grained mafic intrusive pebbles occur at their highest levels in till samples collected immediately over or just down-ice from the noritic phase of the SIC as well as over Nipissing diabase (Figure 37). Values exceeding 31% are not uncommon over the source rocks and diminish rapidly to background levels within 5 to 10 km.

Non-equigranular felsic-intermediate intrusive pebbles occur at their highest levels in till samples collected over the Levack gneissic terrain (Figure 38). Values exceeding 66% of the total pebble fraction are not uncommon within this area. In the eastern half of the study area, this component accounts for between 24 and 47% of the total up to 7.5 km in the down-ice direction. Levack gneisses diminish much more quickly over the western half of the study area.

The metasedimentary pebble data is interesting in that it displays patterns that can be both easily related to known bedrock sources as well as others more difficult to explain. There are 3 distinct areas that

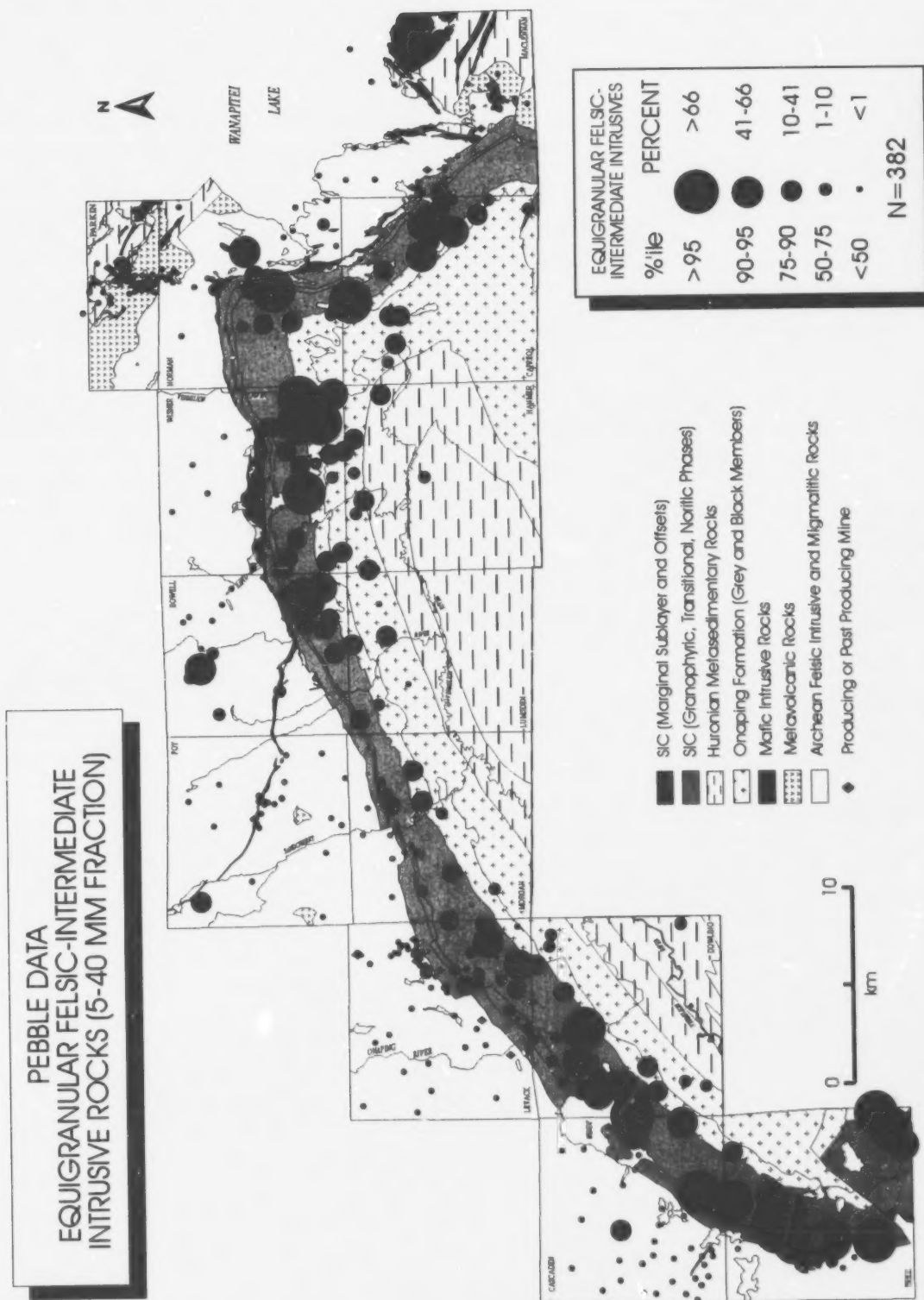


Figure 36. Regional distribution of equigranular felsic-intermediate intrusive pebbles in C-horizon till.

**(3-45 NMI FRACTION)**

N

WAPITI LAKE

FOT BOYELL ROMAN WAPITI LAKE

LETUCE LAKES

0 10 km

| COARSE-GRAINED<br>MAFIC INTRUSIVES |         |
|------------------------------------|---------|
| %ile                               | PERCENT |
| >95                                | >31     |
| 90-95                              | 19-31   |
| 75-90                              | 13-19   |
| 50-75                              | 8-13    |
| <50                                | <8      |

SIC (Marginal Sublayer and Offsets)  
SIC (Granophytic, Transitional, Natick Phases)  
Huronian Metasedimentary Rocks  
Onaping Formation (Grey and Black Members)  
Mafic Intrusive Rocks  
Melavolcanic Rocks  
Archean Felsic Intrusive and Migmatitic Rocks  
Producing or Past Producing Mine

N = 382

**Figure 37.** Regional distribution of coarse-grained mafic intrusive pebbles in C-horizon till.

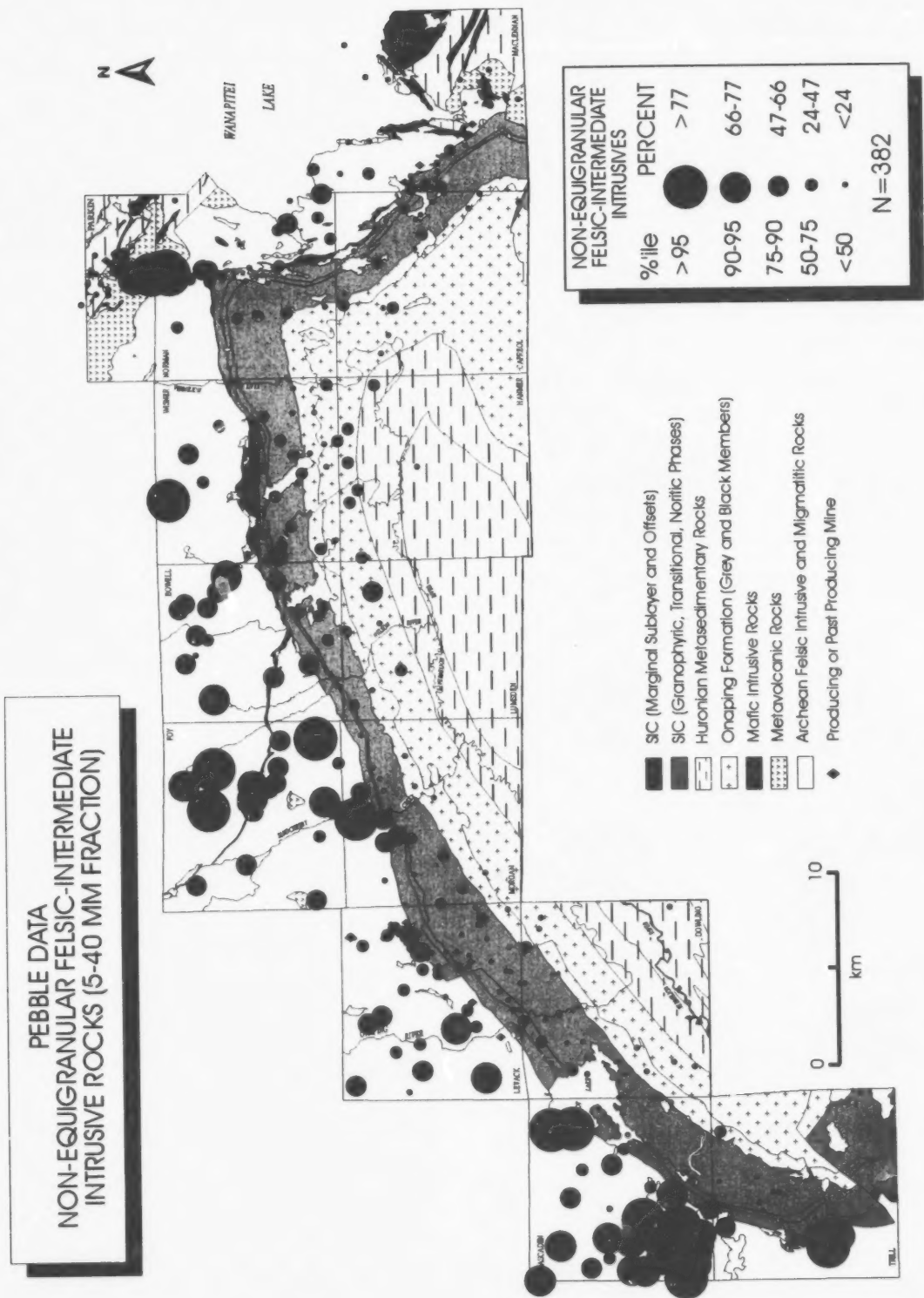


Figure 38. Regional distribution of non-equigranular felsic-intermediate intrusive pebbles in C-horizon till.

contain elevated concentrations of metasedimentary pebbles (Figure 39). Till samples collected from the south end of Lake Wanapitei and from central Parkin and north-central Norman townships usually contain greater than 54% metasedimentary pebbles and commonly in excess of 74%. At the south end of Lake Wanapitei, levels of metasedimentary pebbles of between 54 and 74% persist up to 5 km into the Sudbury basin. In north-central Norman Township, metasedimentary pebbles account for between 25 and 54% of the total despite being in excess of 5 km down-ice from the Cobalt Embayment. Till samples collected from a large area centred on the town of Levack and extending into northern Dowling and western Morgan townships contain high concentrations of Huronian metasedimentary pebbles even though the nearest outcrops are located 10 to 15 km to the north in the up-ice direction. This exotic component was probably transported englacially prior to being deposited within this region. Distinctive green cherts, presumably derived from the Gordon Lake Formation, are commonly encountered in the pebble fraction of tills collected from this region. The nearest known source of this chert is located nearly 100 km to the northeast. This distal component within tills of the Levack area should be considered when interpreting geochemical results. Concentrations of metasedimentary pebbles are also elevated in till samples collected from the Cartier Moraine. This observation is not unexpected as moraines typically contain a clast lithology component that is far-travelled.

Metavolcanic pebbles of both mafic and felsic-intermediate composition generally occur at low levels within the study area (Figures 40 and 41). Higher levels occur in Parkin and north-central Norman townships where a thin sliver of Archean greenstone is present as well as in south-central MacLennan Township where metavolcanic rocks belonging to the Stobie Formation occur. As was the case with the metasedimentary component, till samples collected from the Levack area also contain elevated concentrations of metavolcanic pebbles. These pebbles are likely derived from the Benny greenstone belt which is located approximately 20 km to the north. Local clusters of samples containing elevated mafic extrusive pebble counts occur in southwestern Cascaden, northeastern Bowell and southeastern Norman townships. The significance of these clusters is not known. They may be related to small, unmapped bodies of mafic metavolcanic rocks within the Levack Gneissic Complex.

Fine-grained, mafic intrusive pebbles are, for the most part, randomly distributed across the study area (Figure 42). Local, unexplained concentrations occur in southwestern Cascaden Township and southeastern Norman/northeastern Capreol townships. In places, it appears that clusters of this lithology are spatially associated with the noritic phase of the SIC.

Several conclusions can be drawn from a synthesis of the patterns depicted by the pebble information. These should assist with the interpretation of the regional geochemical datasets.

1. The pebble data suggest that most tills reflect local variations in bedrock composition.
2. Host rock lithologies, i.e., those underlying the sample sites, account for a significant proportion of the total pebble count close to their source and quickly fall to background levels within a few kilometres.
3. Despite certain areas containing distally derived clasts, there appears to be a local component to the pebble fraction.
4. Areas of poorly understood pebble trends may indicate the presence of unmapped bedrock units.

## HEAVY MINERALS IN TILL

Non-magnetic heavy minerals were isolated from 7 to 10 kg bulk C-horizon till samples for geochemical determinations. Gold grains were isolated, counted and classified by size and shape during the tabling stage, and then returned to the pre-concentrate prior to using density dependent settling in methylene iodide set to a specific gravity of 3.3. Magnetic minerals were isolated from the methylene iodide HMC using an automagnet. Heavy mineral weight data and detailed gold grain information are contained in Appendices B and C.



PEBBLE DATA  
METASEDIMENTARY ROCKS  
(5-40 MM FRACTION)

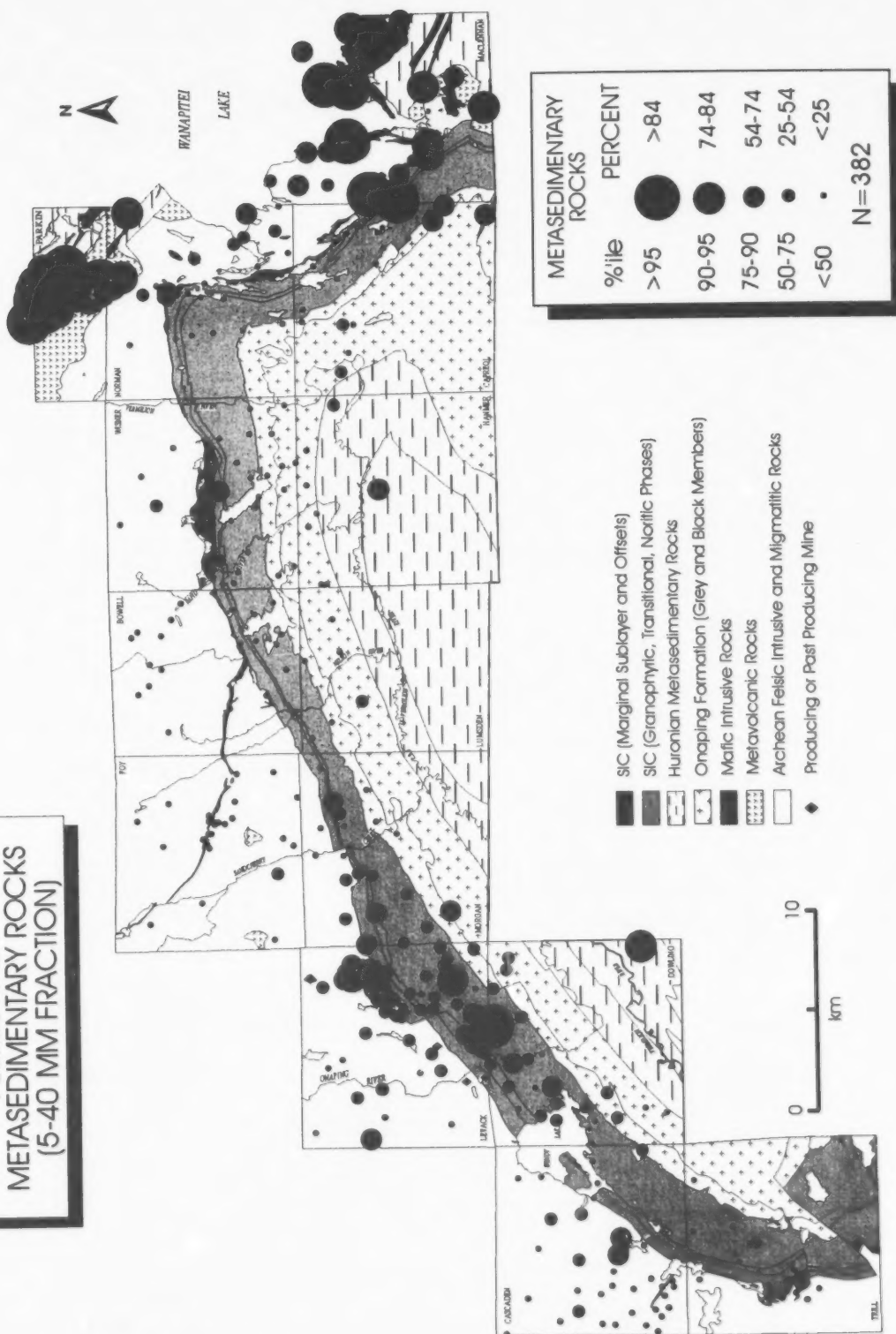


Figure 39. Regional distribution of metasedimentary pebbles in C-horizon till.

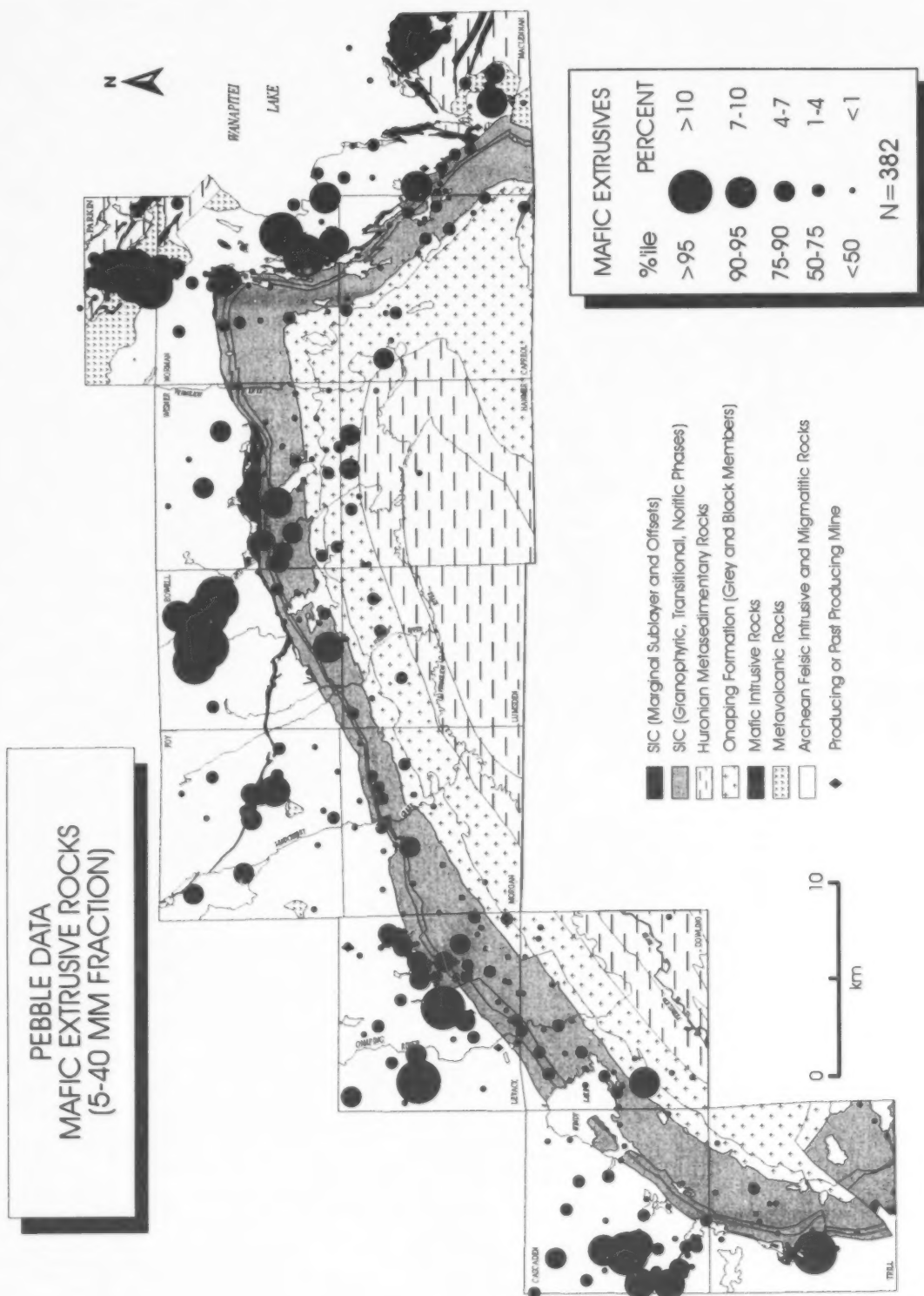


Figure 40. Regional distribution of mafic extrusive pebbles in C-horizon till.

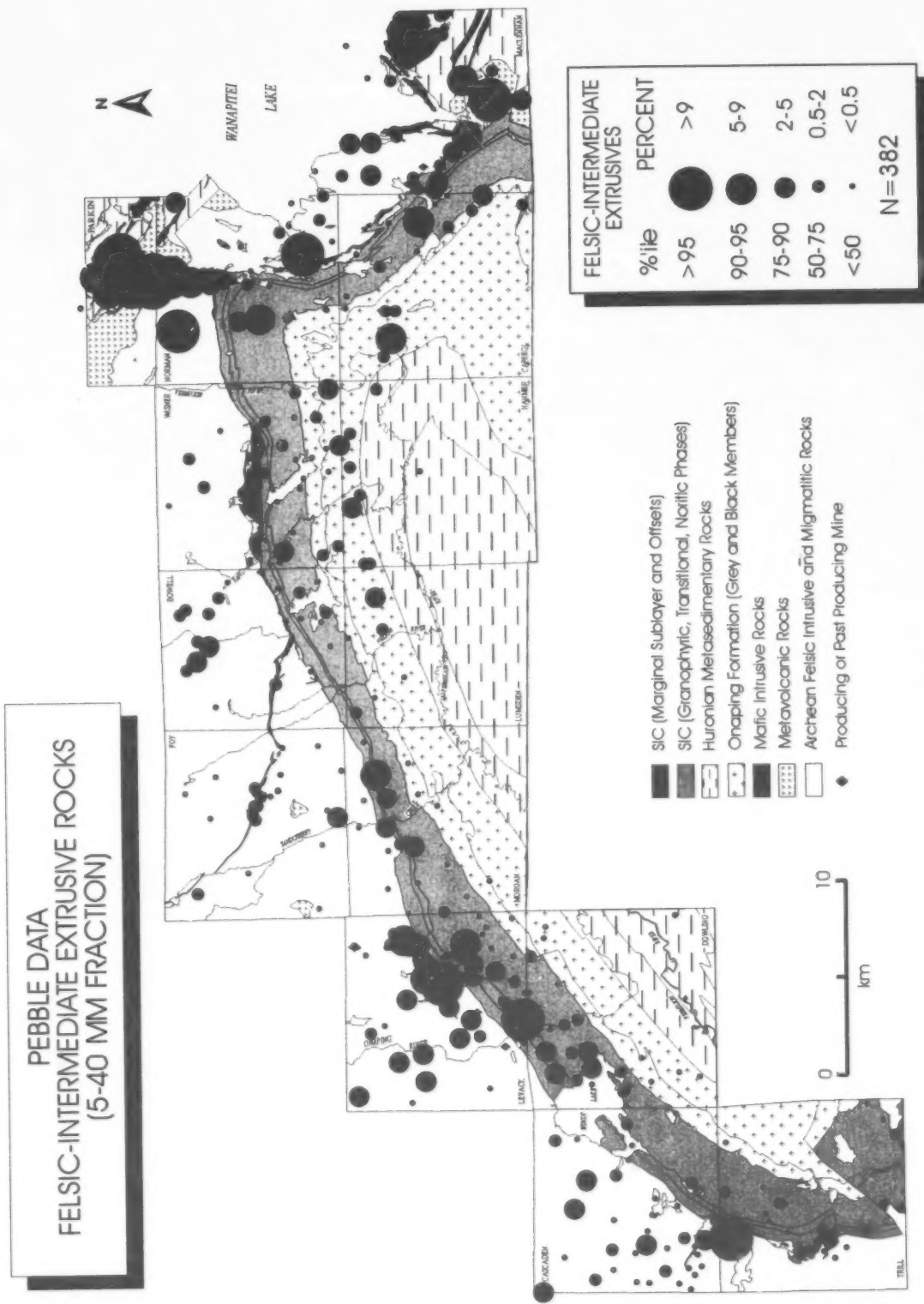


Figure 41. Regional distribution of felsic-intermediate extrusive pebbles in C-horizon till.

PEBBLE DATA  
FINE-GRAINED MAFIC INTRUSIVE ROCKS  
(5-40 MM FRACTION)

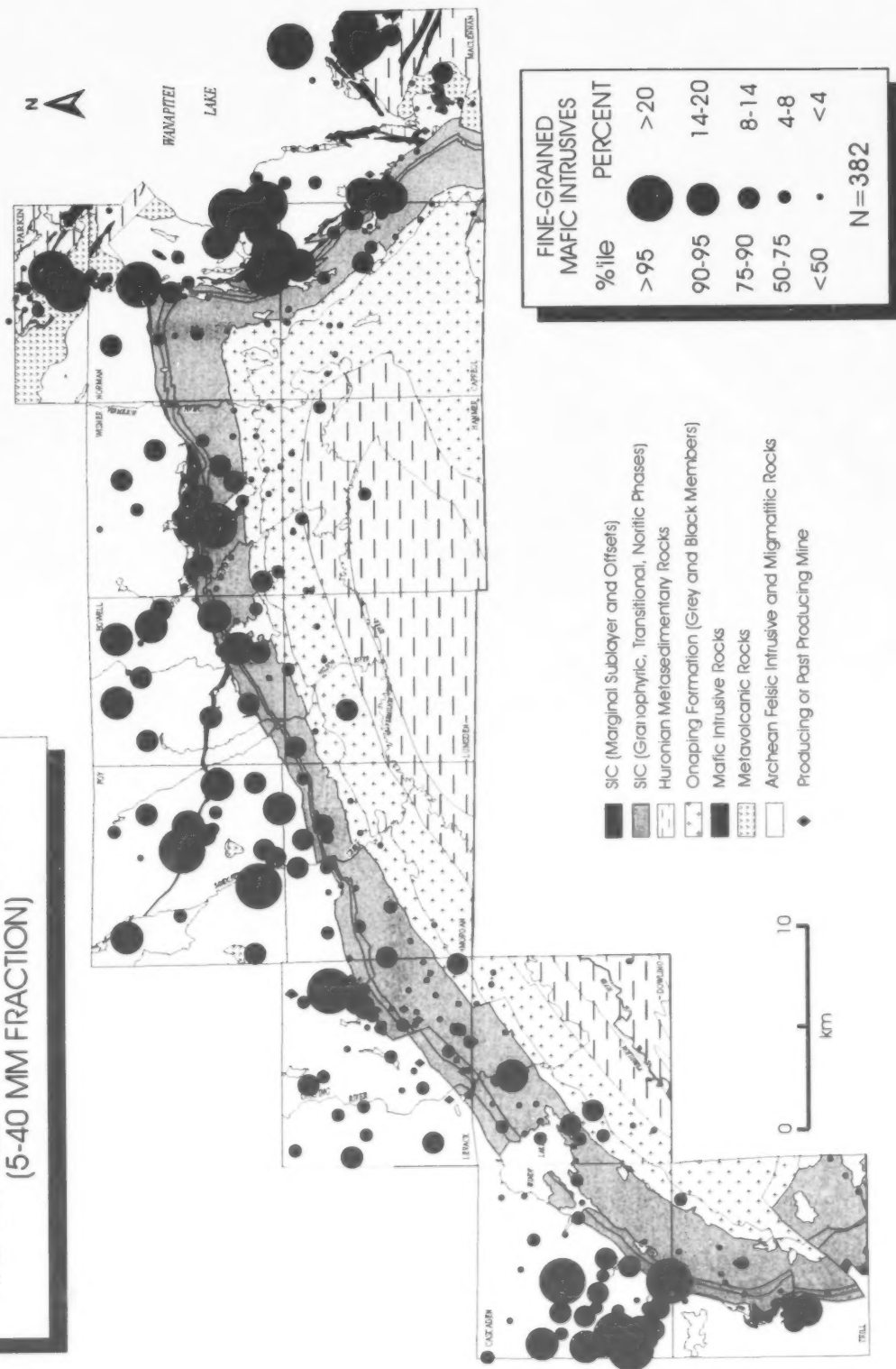


Figure 42. Regional distribution of fine-grained mafic intrusive pebbles in C-horizon till.

The percentages of total heavy minerals and magnetic minerals contained within till samples can provide useful information with regard to source rocks. Most till samples contain between 0.2 and 0.8% heavy minerals by weight. The percentage of total heavy minerals tends to be highest over the SIC and over Archean greenstone in Parkin Township (Figure 43). The noritic phase of the SIC is probably liberating large quantities of pyroxene, olivine, magnetite, ilmenite, chromite and sulphide. Mafic metavolcanic and diabasic rocks in Parkin Township are also probably releasing similar heavy mineral assemblages resulting in higher proportions of heavy minerals in the till. Samples collected over Levack footwall gneisses tend to have lower heavy mineral contents. Exceptions occur in north-central Bowell and southwestern Cascaden townships. Till samples collected from these areas also contained anomalously high numbers of mafic metavolcanic and/or fine-grained mafic intrusive pebbles, the sources of which are yet to be determined.

The magnetic heavy mineral fraction consists primarily of magnetite which occurs as an accessory mineral in many rock types including, norite, diorite and diabase. Most of the HMCs contain between 25 and 50% magnetics. Higher values occur locally in many samples collected over or in close proximity to the noritic phase of the SIC (Figure 44). Anomalously high values also occur in southwestern Cascaden Township where till samples contain high concentrations of diabase pebbles, in east-central Foy Township immediately down-ice from the Nickel Offset Mine and in south-central Wisner Township where there is no apparent lithologic explanation for the anomaly.

The gold grain content of till can indicate the potential for precious metal mineralization within the study area. This information is most pertinent to areas underlain by Archean supracrustal rocks as occur in the extreme northeastern corner of the study area. A number of gold prospects also occur along the eastern side of the study area in quartz-carbonate veins cutting sodium metasomatized host rocks. Visible native gold has been recognized at many of these showings. Highly fractionated Sudbury ores, as are commonly encountered in footwall-type ore bodies, can also contain spectacular swarms of native silver and, more rarely, electrum ( $\text{Au}_{0.5}\text{Ag}_{0.5}$ ) veinlets within bornite-mineralized country rock (Jago et al. 1994). Gold grains in till may originate from this style of mineralization.

The regional distribution of particulate gold in till normalized to 10 kg of table feed is plotted in Figure 45. Table feeds ranged between 3.7 and 10.4 kg with 7.3 kg being the average. Spatial variations in regional background exist within the study area and are best explained by local variations in source rocks. Samples collected over Archean terrane in Parkin and Norman townships commonly yield normalized gold grain counts ranging between 4 and 15 grains with the highest being 119 grains. Local gold sources along the trend of the Parkin Offset dike are indicated by the high proportion of samples containing pristine and/or modified grain shapes. A more comprehensive discussion of the gold grain results obtained from this area is contained in Ontario Geological Survey Open File Report 5893 (Bajc 1994). Background gold grain counts are also elevated over Levack and northern Dowling townships. Many samples collected within this area contain greater than 4 gold grains per 10 kg table feed and a few exceed 25. Elevated background within this area may be related to the erosion and dispersion of gold from the Benny greenstone belt, which is located approximately 10 to 20 km to the northwest. Most of the gold grains recovered from this area display reshaped surface textures indicating some degree of transport. Few gold occurrences have been identified within this belt. The gold grain results may indicate enhanced potential for new gold discoveries. Normalized gold grain counts over the eastern townships (Norman, Capreol and MacLennan townships) commonly exceed 4 grains and occasionally exceed 16 grains. This pattern is likely attributed to the dispersion of mineralized rock from the Archean greenstone belt in Parkin Township as well as from a number of gold showings around the perimeter of Wanapitei Lake. Elevated gold grain counts in the vicinity of the Whistle Mine may be related to local Sudbury-type mineralization.

In addition to the trends mentioned above, a number of significant single sample anomalies were recognized. A normalized gold grain count of 57 from sample site 92-AFB-159 in northwestern Capreol Township is unusual in that it was obtained from a till sample collected at the crest of the Cartier Moraine. Till samples collected from moraines are usually difficult to trace back to source as they are often, at least partially, composed of sediment that was carried either within or on top of the glacier. This englacial and supraglacial debris can be long-travelled. At site 93-AFB-225, in northwestern Cascaden Township, a normalized gold grain count of 28 was obtained from a sample collected on a hummock of bouldery





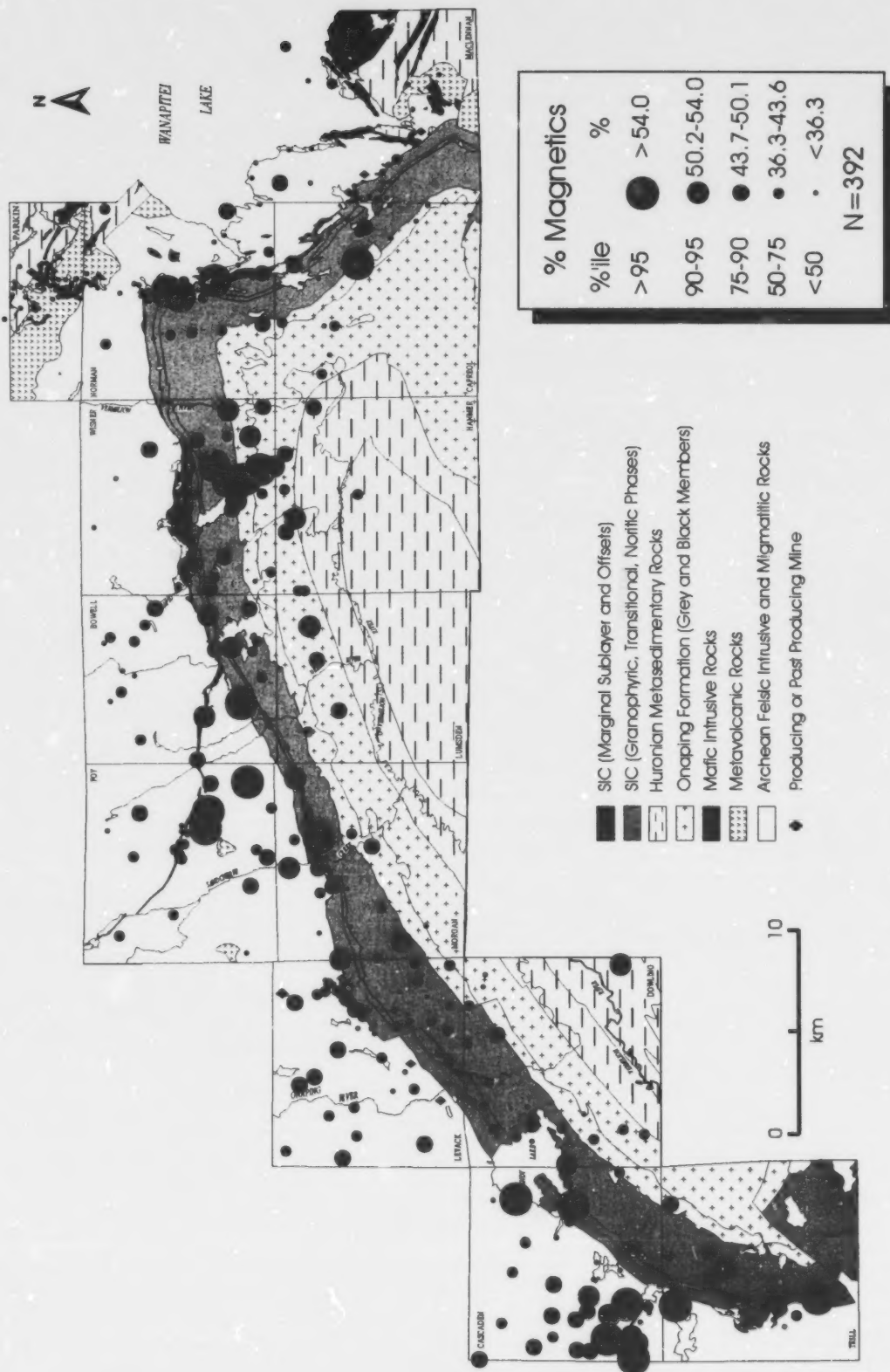


Figure 44. Regional distribution of the percent magnetic heavy minerals in C-horizon till (>3.3 S.G.).



supraglacial till. A non-local source is once again suggested for this anomaly. At site 92-AFB-031, in central Macleannan Township, a normalized gold grain count of 41 was obtained from a sample of ground moraine flanking a prominent bedrock ridge. Most of these grains displayed reshaped surface textures indicating some degree of transport. This sample was collected from a bedrock ridge less than 1 km south of the Skead Gold Mine where mineralization is hosted by Huronian metasedimentary rocks (Thomson 1961). Additional local gold sources are indicated by this anomaly.

Only 1 grain of platinum was recovered from the survey area. Sample 92-AFB-4127, which was collected from the extreme northwestern corner of Levack Township, contained a single platinum grain measuring 75X125  $\mu\text{m}$  in diameter. The subglacial nature of the till sample which contained this grain suggests a proximal source. This anomaly may be related to an as yet undiscovered offset dike related to the SIC. Additional work is recommended for this area to determine the significance of this grain.

## GEOCHEMISTRY

Aside from providing information on the background concentration of metals in the surficial environment, the surficial geochemical datasets have identified a number of potentially significant exploration targets. Figures summarizing the results of the various media sampled are presented in the following sections. The discussion will focus primarily on elements associated with Sudbury-type mineralization. These include Ni, Cu, Pt, Pd, Au, Cr, Co, Ag, As, Te, Bi, Pb, Sb and Se. Proportionally-sized dot plots for each of these elements are located in Appendices D to J. Summary statistics, frequency histograms, cumulative probability plots and Pearson moment correlation matrices of geochemistry for the near-total and partial datasets of humus, B- and C-horizon till are also presented in Appendices K to N.

### Humus (-177 $\mu\text{m}$ fraction)

Summary diagrams of humus geochemistry are presented in Figures 46 and 47 for the near-total aqua regia and the partial sodium pyrophosphate digestions, respectively. The primary geochemical signals are partially masked, to varying degrees, by anthropogenic sources of metals. Both the aqua regia and sodium pyrophosphate datasets display a high degree of contamination over the eastern half of the study area where the effects of smelter emissions are most intense (Anomaly 1, Figure 46 and Anomaly 1, Figure 47). Within this zone of intense metal loading, one can still detect a weak signal related to the Victor/Nickel Rim (Anomaly 8, Figure 47), Whistle (Anomaly 2, Figure 47) and Milnet ore bodies (Anomaly 3, Figure 47). The signal is, however, strongest in the partial extraction (sodium pyrophosphate) dataset. Sodium pyrophosphate-extracted Co and Pb anomalies also occur over Nipissing diabase in east-central Macleannan Township (Anomaly 10, Figure 47) and over metavolcanic and metasedimentary rocks of the Stobie Formation in south-central Macleannan Township (Anomaly 9, Figure 47).

A strong, multi-element anomaly, recognizable in both the aqua regia and sodium pyrophosphate datasets, is centred on the Strathcona embayment where several Ni-Cu-PGE producers are situated (Anomaly 2, Figure 46 and Anomaly 4, Figure 47). The aqua regia anomaly is significantly larger in aerial extent, extending southward and eastward into Dowling and Morgan townships, respectively. These areas have been strongly impacted by infrastructure development related to mine development. Examples of such development include:

- 1) the Strathcona Mill;
- 2) several large tailings facilities;
- 3) rail transfer of ore from INCO Ltd. mines within the area to the Clarabelle Mill in Copper Cliff;
- 4) ground transfer of slurry from the Strathcona Mill to the Falconbridge smelter;
- 5) miscellaneous sources of contamination including rock excavation, road building, mine ventilation, etc.

The aqua regia digestion appears to be significantly more sensitive to this type of disturbance as indicated by the more aerially extensive anomaly. The partial digest displays a closer spatial association





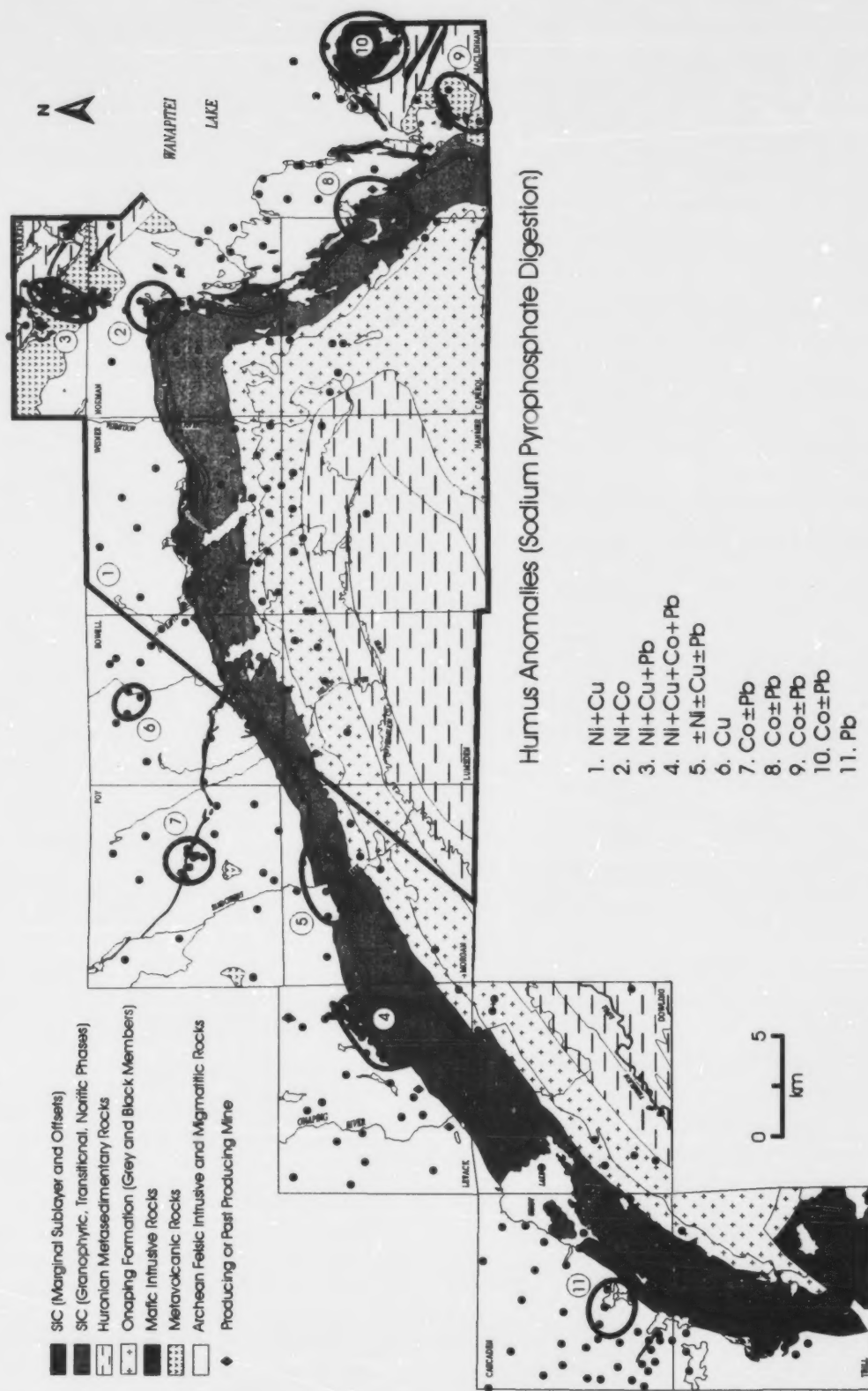


Figure 47. Summary diagram of geochemical anomalies in humus (sodium pyrophosphate digestion).

with known surface mineralization and glacially-dispersed overburden. This may indicate that the "additional" areal contamination shown in the aqua regia dataset is in the form of undecomposed/unoxidised sulphides.

A number of other geochemically anomalous areas have been identified in the humus datasets. These areas do not appear to have been affected by surface contamination based on their position with respect to current and past operating smelters and mine infrastructure. From east to west, they include:

- 1) a Cu anomaly in north-central Bowell Township (Anomaly 6, Figure 47);
- 2) a multi-element anomaly in the vicinity of the Nickel Offset mine in Foy Township (Anomaly 8, Figure 46 and Anomaly 7, Figure 47);
- 3) a multi-element anomaly in north-central Morgan Township centred on the Sandcherry Creek (Anomaly 3, Figure 46 and Anomaly 5, Figure 47);
- 4) a Te anomaly in northwest Levack Township (Anomaly 7, Figure 46)
- 5) a multi-sample anomaly centred on Cascaden Lake (Anomaly 10, Figure 46 and Anomaly 11, Figure 47);
- 6) a Ni-Pt-Au anomaly centred on the Ministic Offset (Anomaly 4, Figure 46);
- 7) a multi-sample anomaly associated with the Trill embayment (Anomaly 5, Figure 46);
- 8) a multi-sample As-Sb anomaly in southeastern Trill Township (Anomaly 9, Figure 46);
- 9) a multi-sample Pt-Pd-Au anomaly in north-central Trill Township (Anomaly 6, Figure 46)

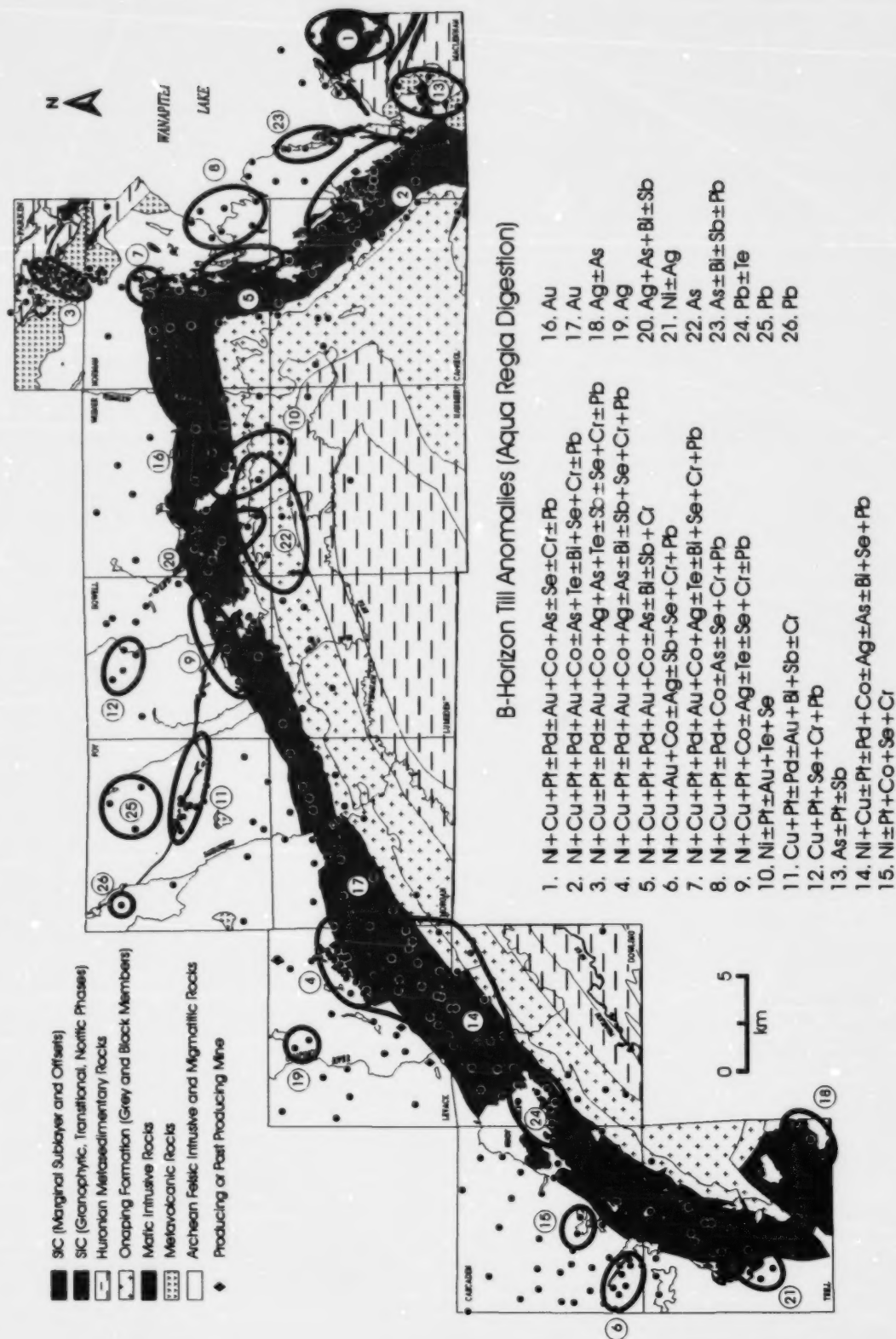
Some of these anomalies are not associated with known mineralization and should be investigated further. Priority should be given to those anomalies located either within the footwall or close to the footwall/SIC contact.

## **B-Horizon Till (-63 $\mu$ m fraction)**

The patterns depicted by the B-horizon datasets have not only confirmed the position of known sources of mineralization but have also defined a number of potentially significant exploration targets (Figures 48 and 49). The close correlation between B-horizon geochemistry and known mineralization validates this method for surficial programs of mineral exploration within the Sudbury mining camp. It is important to note that the parent material for the B-horizon dataset is almost exclusively till. B-horizon soils derived from stratified deposits of sand, silt and clay should be interpreted with caution.

The aqua regia dataset contains a significantly greater number of anomalies than does the selective leach dataset. The reason for this difference is not understood. Those anomalies associated with known mineralization include:

1. the Victor/Nickel Rim mines area (Anomaly 2, Figure 48 and Anomaly 9, Figure 49);
2. the Ella Lake-Waddell Lake area along the east rim (Anomaly 5, Figure 48 and Anomaly 8, Figure 49);
3. the Whistle Embayment area (Anomaly 7, Figure 48 and Anomaly 7, Figure 49);
4. the Parkin Offset area (Anomaly 3, Figure 48 and Anomaly 6, Figure 49);
5. an area of mineralized sublayer in central Wisner Township (Anomaly 16, Figure 48);
6. an area of mineralized sublayer in south-central Bowell Township (Anomaly 9, Figure 48 and Anomaly 4, Figure 49);
7. a portion of the Foy Offset dike in east-central Foy Township (Anomaly 11, Figure 48 and Anomaly 13, Figure 49);
8. the Strathcona Embayment in east-central Levack Township (Anomalies 4 and 14, Figure 48 and Anomaly 3, Figure 49);
9. the Ministic Offset dike in southwestern Cascaden Township (Anomaly 6, Figure 48 and Anomaly 2, Figure 49);
10. the Trill Embayment in west-central Trill Township (Anomaly 21, Figure 48 and Anomaly 1, Figure 49).





A number of additional anomalies have also been recognized. These can be subdivided into 2 main groups; those contained within the footwall to the SIC and those contained within the Sudbury structure. Footwall-type anomalies have been identified:

1. over Nipissing diabase in northeastern Maclellan Township (Anomaly 1, Figure 48 and Anomaly 10, Figure 49);
2. over metavolcanic and metasedimentary rocks in south-central Maclellan Township (Anomaly 13, Figure 48);
3. along the southwest shore of Wanapitei Lake (Anomaly 23, Figure 48);
4. in an area centred on West Bay of Wanapitei Lake (Anomaly 8, Figure 48);
5. in north-central Bowell Township (Anomaly 12, Figure 48 and Anomaly 14, Figure 49);
6. in northeastern and northwestern Foy Township (Anomalies 25 and 26, Figure 48);
7. in north-central Levack Township (Anomaly 19, Figure 48 and Anomaly 12, Figure 49);
8. in an area centred on Cascaden Lake in central Cascaden Township (Anomaly 15, Figure 48).

Some of these anomalies lack the ore-forming elements (Cu-Ni-Co-Pt-Pd) present in Sudbury-type mineralization. Their significance requires additional investigation.

Anomalies within the SIC include:

1. the Joe Lake-Frenchman Lake area in southeastern Wisner Township (Anomaly 10, Figure 48 and Anomaly 5, Figure 49);
2. the Rapid River area in southwestern Wisner Township (Anomaly 20, Figure 48 and Anomaly 15, Figure 49);
3. an area underlain by Onaping Formation breccias in southwestern Wisner and northwestern Hanmer townships (Anomaly 22, Figure 48)
4. the Morgan Lake area of west-central Morgan Township (Anomaly 17, Figure 48);
5. an area of southeastern Levack and northeastern Dowling townships south of the Strathcona Embayment (Anomaly 14, Figure 48);
6. an area straddling the Cascaden/Dowling township line south of Windy Lake (Anomaly 24, Figure 48);
7. the southeastern corner of Trill Township just west of Fairbank Lake (Anomaly 18, Figure 48).

The significance of these anomalies is attributed to regional variations in source rock compositions rather than primary mineralization.

## **C-Horizon Till (-63 $\mu$ m fraction)**

The C-horizon dataset shares many of the characteristics of the B-horizon geochemistry presented above. Summary diagrams are contained in Figures 50 and 51. Anomalies associated with known mineralization include:

1. the Victor/Nickel Rim mines area (Anomaly 7, 0 and Anomaly 11, Figure 51);
2. the Ella Lake-Waddell Lake area of the east rim (Anomaly 5, Figure 50 and Anomaly 10, Figure 51);
3. the Whistle Embayment area (Anomaly 5, Figure 50 and Anomaly 9, Figure 51);
4. the Parkin Offset area (Anomaly 4, Figure 50 and Anomaly 8, Figure 51);
5. an area of mineralized sublayer in south-central Bowell Township (Anomaly 8, Figure 50 and Anomaly 6, Figure 51);
6. a portion of the Foy Offset dike in east-central Foy Township (Anomaly 11, Figure 50 and Anomaly 15, Figure 51);
7. the Strathcona Embayment in east-central Levack Township (Anomaly 3, Figure 50 and Anomaly 5, Figure 51);
8. the Ministic Offset dike in southwestern Cascaden Township (Anomaly 2, Figure 50 and Anomaly 2, Figure 51);





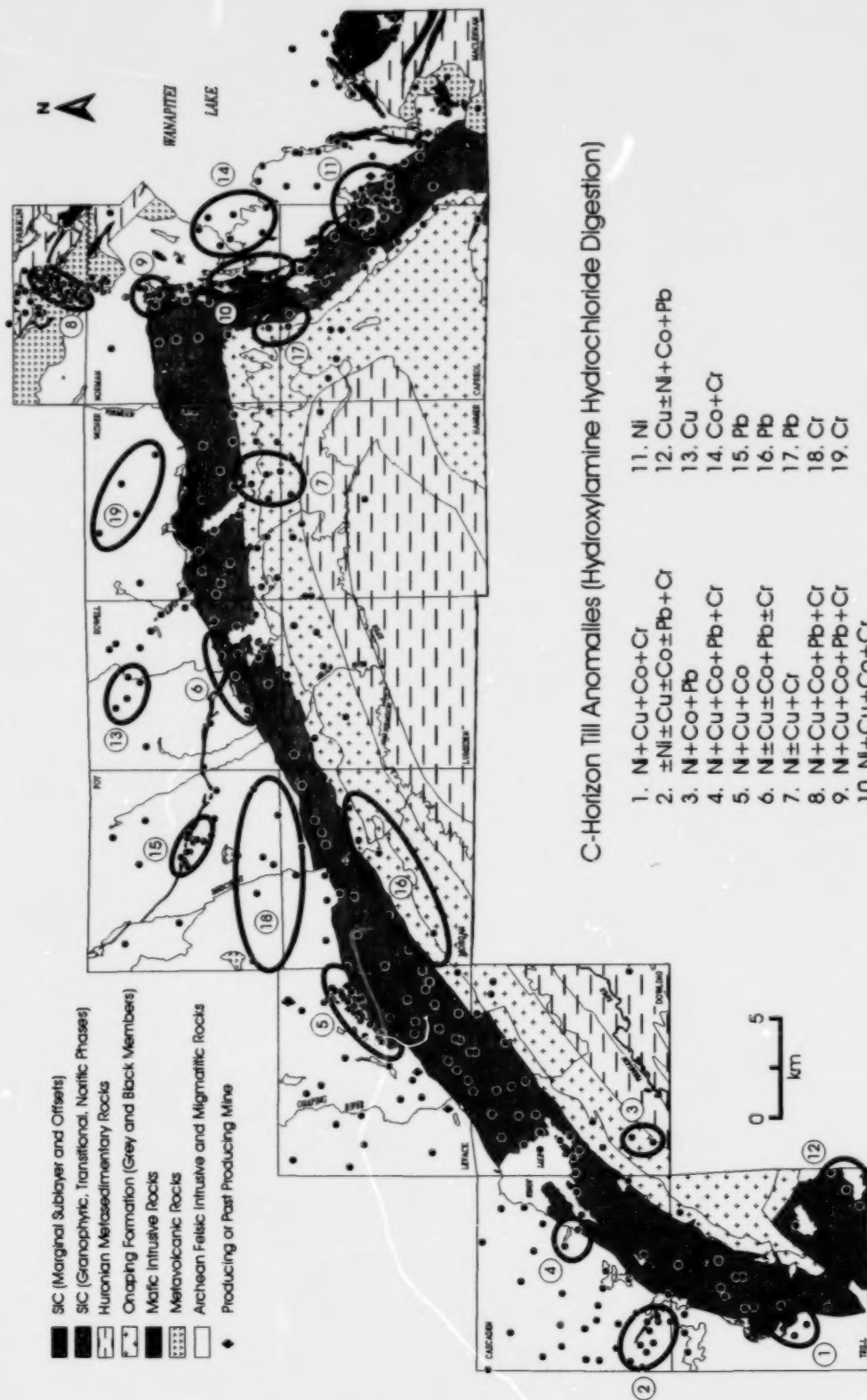


Figure 51. Summary diagram of geochemical anomalies in C-horizon till (hydroxylamine hydrochloride digestion).

9. the Trill Embayment in west-central Trill Township (Anomaly 1, Figure 50 and Anomaly 1, Figure 51);

A number of additional anomalies have also been identified both within and outside of the SIC. Not all of these are shared by both the aqua regia and hydroxylamine hydrochloride datasets.

Those anomalies situated outside of the SIC include:

1. a cluster of samples over Nipissing diabase in east-central Maclellan Township (Anomaly 12, Figure 50);
2. a few samples on the southwest shore of Wanapitei Lake (Anomaly 16, Figure 50);
3. a cluster of samples centred on West Bay of Wanapitei Lake (Anomaly 19, Figure 50 and Anomaly 14, Figure 51);
4. a broad zone of anomalous Cr in north-central Wisner Township (Anomaly 19, Figure 51);
5. a cluster of samples in north-central Howell Township (Anomaly 18, Figure 50 and Anomaly 13, Figure 51);
6. a few samples in northeastern and northwestern Foy Township (Anomalies 20 and 21, Figure 50);
7. a broad zone of anomalous Cr in southern Foy Township (Anomaly 18, Figure 51);
8. a broad multi-element anomaly in southwestern Cascaden Township (Anomaly 2, Figure 50).

Areas of anomalous geochemistry within the SIC include:

1. an area extending from Ella and Waddell lakes in south-central Norman Township southwesterly towards Greens Lake in northwestern Capreol Township (Anomalies 22 and 26, Figure 50 and Anomaly 17, Figure 51);
2. the Joe Lake-Frenchman Lake area in southeastern Wisner Township (Anomaly 15, Figure 50 and Anomaly 7, Figure 51);
3. an area underlain by granophyre extending from just west of Nelson Lake in Howell Township to just east of Joe Lake in Wisner Township (Anomaly 23, Figure 50);
4. an area following the footwall/SIC contact in northeastern Morgan Township (Anomalies 17 and 25, Figure 50);
5. an area underlain by Onaping Formation breccias in southwestern Morgan Township (Anomaly 16, Figure 51);
6. a large area of anomalous geochemistry in southeastern Levack and northwestern Dowling townships (Anomalies 14 and 24, Figure 50);
7. an anomaly along the footwall/SIC contact in east-central Cascaden Township (Anomaly 10, Figure 50 and Anomaly 4, Figure 51);
8. a cluster of samples over Onaping Formation breccias in southwestern Dowling Township (Anomaly 13, Figure 50 and Anomaly 3, Figure 51);
9. a cluster of samples in the southeastern corner of Trill Township just west of Fairbank Lake (Anomaly 9, Figure 50 and Anomaly 12, Figure 51);

Those anomalies situated over the Onaping Formation breccias are probably caused by sulphide minerals that occur within both the Grey and Black Members. Sulphide minerals include: 1) pyrrhotite; 2) chalcopyrite; 3) pyrite; and 4) pyrite in decreasing order of abundance (Muir and Peredery 1984). Total sulphide content within the breccias can reach 5% locally but usually occur at levels less than 1%. Anomalies situated over granophyric and transitional phases of the SIC may be attributed to glacial dispersal from the SIC/footwall contact.

## **C-Horizon Till (-2 mm non-magnetic HMC fraction)**

The -2 mm non-magnetic heavy mineral fraction of C-horizon till was analyzed using near-total dissolution techniques. Partial leach data are not available for this fraction.

The patterns depicted by this fraction are not unlike those presented by the B- and C-horizon near-total datasets (Figure 52). Strong signals were obtained around all of the present and past-producers as well as proximal to mineralized sublayer and quartz diorite offset dikes. These areas include:

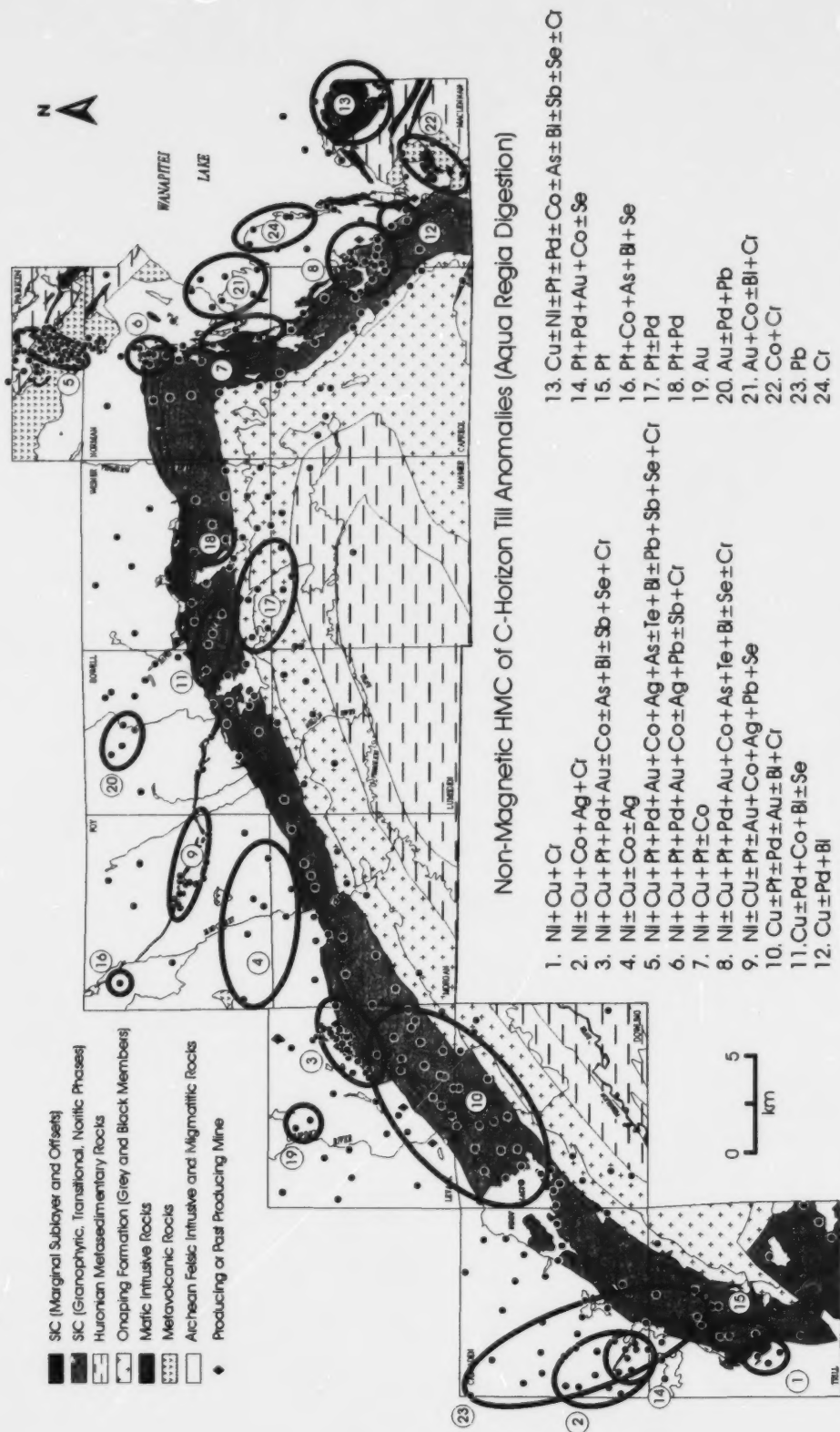


Figure 52. Summary diagram of geochemical anomalies in the non-magnetic HMC fraction of C-horizon till (aqua regia digestion).



1. the Maclellan mine area of the east rim (Anomaly 12, Figure 52);
2. the Victor/Nickel Rim mines area of the east rim (Anomaly 8, Figure 52);
3. the Ella Lake-Waddell Lake area of the east rim (Anomaly 7, Figure 52);
4. the Whistle Embayment area (Anomaly 6, Figure 52);
5. the Parkin Offset area (Anomaly 5, Figure 52);
6. a portion of the Foy Offset dike in east-central Foy Township (Anomaly 9, Figure 52);
7. the Strathcona Embayment in east-central Levack Township (Anomaly 3, Figure 52);
8. the Ministic Offset dike in southwestern Cascaden Township (Anomaly 14, Figure 52);
9. the Trill Embayment in west-central Trill Township (Anomaly 1, Figure 52).

A number of additional anomalies have been recognized both within and outside of the Sudbury structure. Those outside of the SIC include:

1. a cluster of samples in south-central Maclellan Township (Anomaly 22, Figure 52);
2. a cluster of samples over Nipissing diabase in northeastern Maclellan Township (Anomaly 13, Figure 52);
3. several samples along the west shore of Wanapitei Lake (Anomaly 24, Figure 52);
4. a number of samples in an area centred on West Bay of Wanapitei Lake (Anomaly 21, Figure 52);
5. a few samples in north-central Howell Township (Anomaly 20, Figure 52);
6. a single sample in northwestern Foy Township (Anomaly 16, Figure 52);
7. a broad zone of southern Foy and north-central Morgan townships (Anomaly 4, Figure 52);
8. a couple of samples in north-central Levack Township (Anomaly 19, Figure 52);
9. a broad zone of geochemically anomalous samples covering western Cascaden Township (Anomaly 23, Figure 52).

Anomalies within the SIC include:

1. a cluster of samples east of Joe Lake in Wisner Township (Anomaly 18, Figure 52);
2. a cluster of samples overlying the Onaping Formation breccias in southwestern Wisner and northwestern Hanmer townships (Anomaly 17, Figure 52);
3. a group of samples northeast of Nelson Lake (Anomaly 11, Figure 52);
4. a broad zone of southeastern Levack and north-central Dowling Township (Anomaly 10, Figure 52);
5. a cluster of samples in central Trill Township east of the Trill Embayment (Anomaly 15, Figure 52).

## Pilot Biogeochemical Study

Leaves and twigs were collected from the new shoots of 18 white birch trees growing in Maclellan and eastern Capreol townships. This region is under the strong influence of the Falconbridge smelter which is located approximately 5 to 10 km to the south. Samples were collected from the 18 trees both in early May, shortly after the leaves came out, and then in mid-September following the summer growing season. Samples were collected at these intervals to determine whether seasonal/temporal variations related to natural or anthropogenic processes could be detected. As several past-mineral producers are situated within this area, the sampling was also undertaken to determine whether a geochemical signature related to primary mineralization could be detected. Although the sampling density is clearly not adequate for such an evaluation, the slightly higher density around the Victor/Nickel Rim deposits should provide some indication of the potential use of biogeochemistry. Elemental data are available for both the spring and fall sample sets of twigs and only the spring sample set of leaves. Results for 4 elements (Ni, Au, Pt and Pd) are presented in Figures 53 to 55.

A number of observations can be made:

1. There is no apparent correlation between leaf and/or twig geochemistry and the position of mineralized sublayer at the sampling density chosen. At Ferguson Lake, NWT and Rottenstone



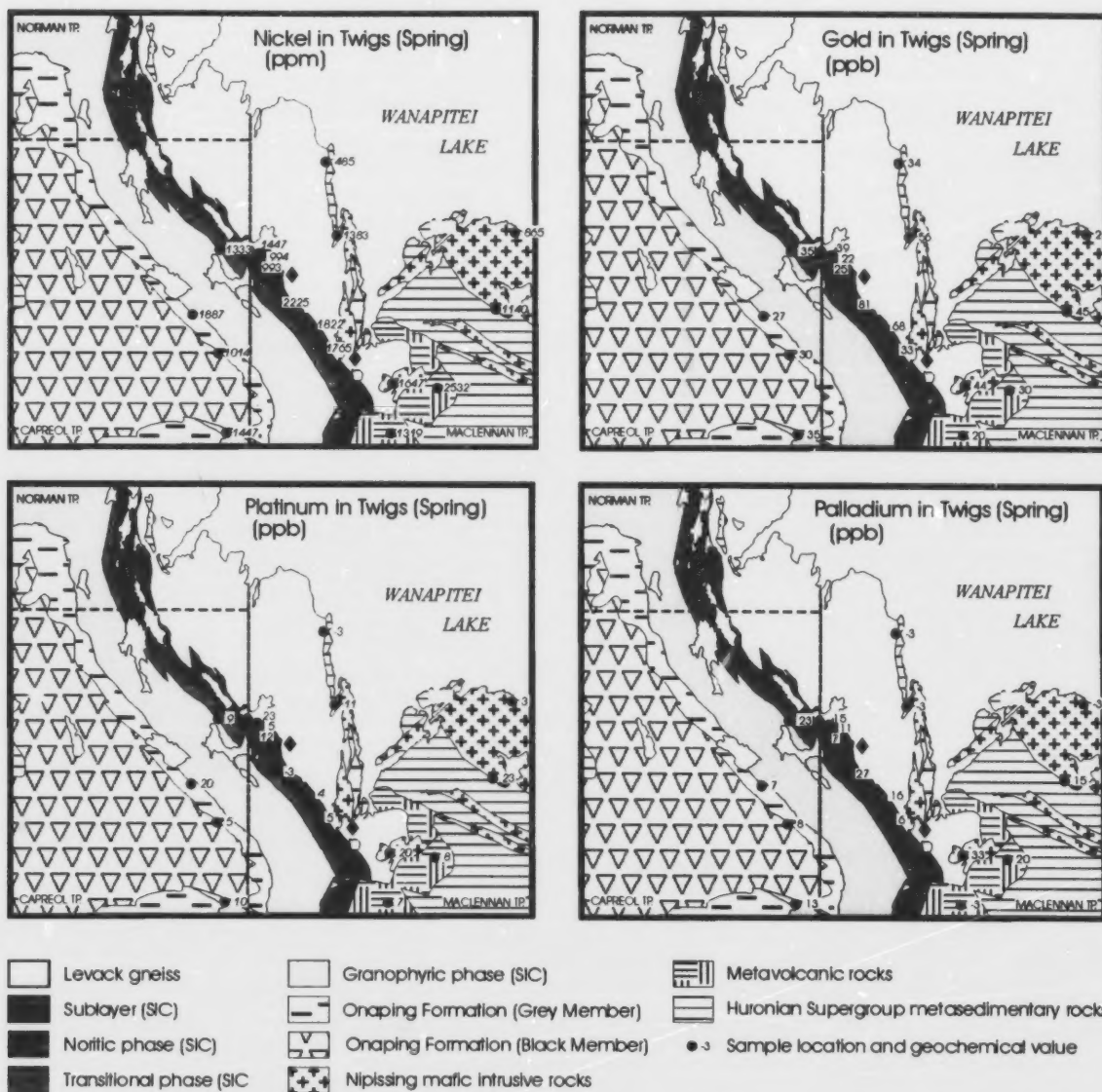


Figure 53. Spatial plots of nickel, gold, platinum and palladium in birch twigs collected during the spring from the southern Wanapitei Lake area.

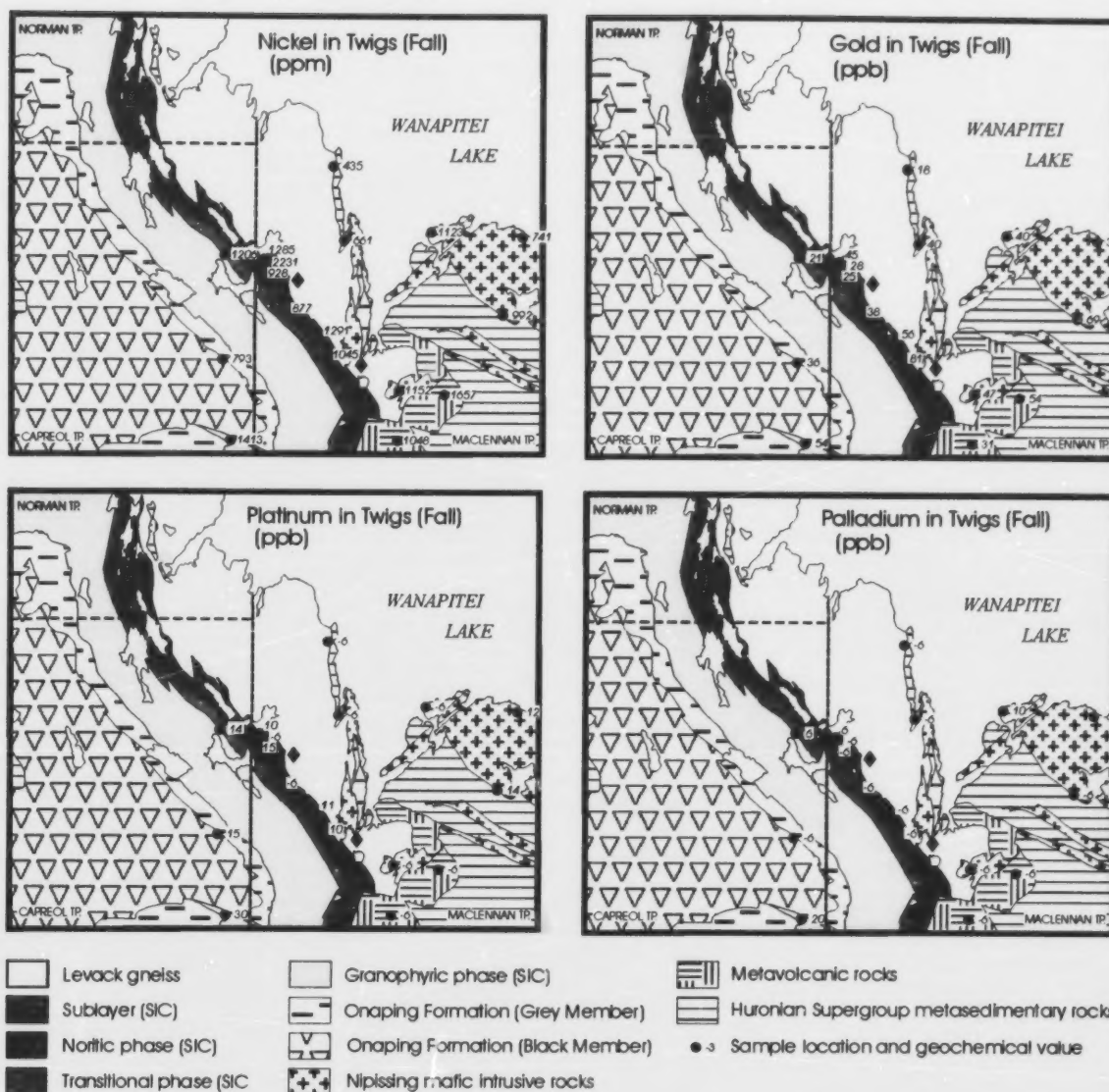


Figure 54. Spatial plots of nickel, gold, platinum and palladium in birch twigs collected during the fall from the southern Wanapitei Lake area.

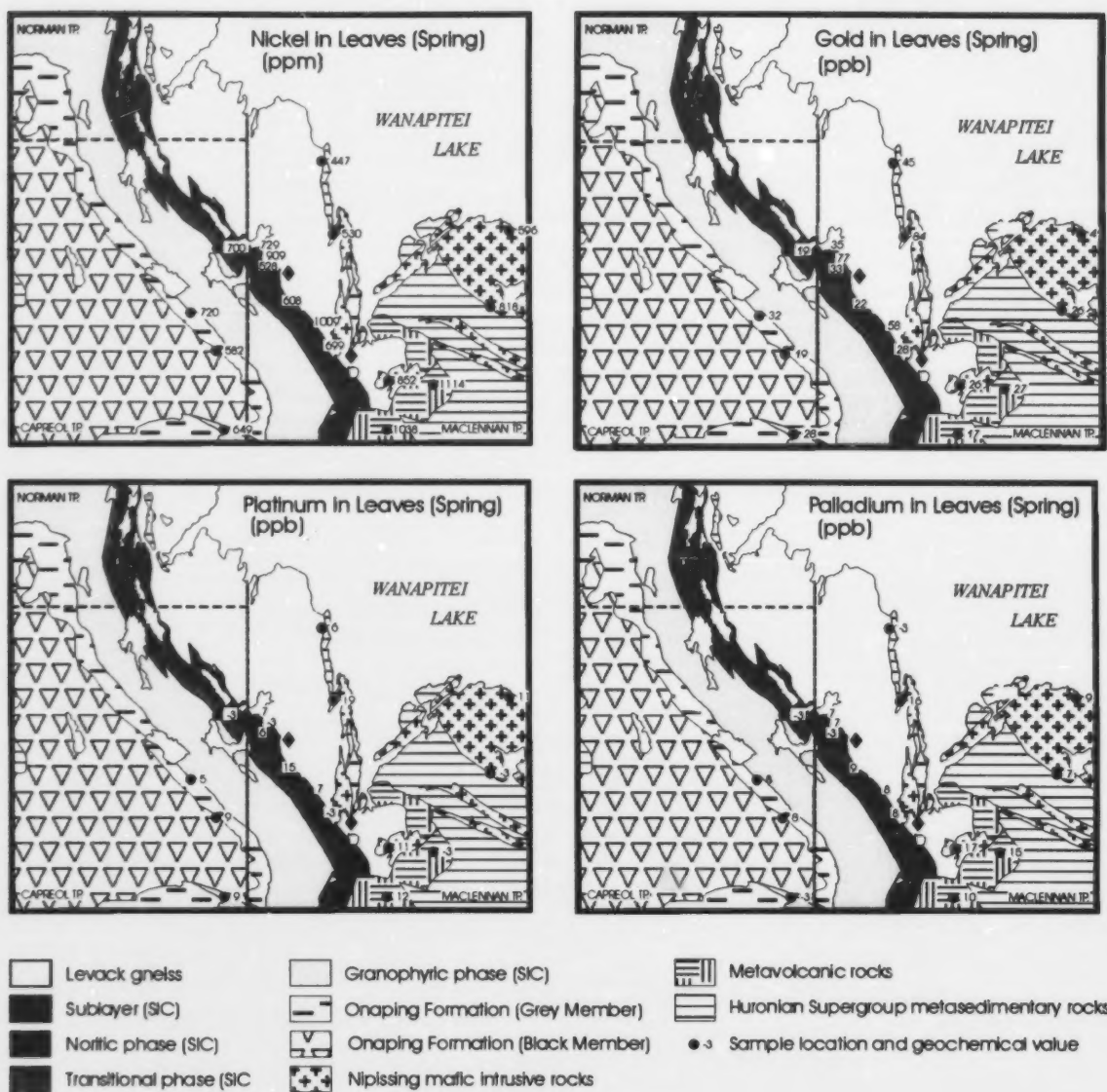


Figure 55. Spatial plots of nickel, gold, platinum and palladium in birch leaves collected during the spring from the southern Wanapitei Lake area.

Lake, Saskatchewan, birch and spruce twigs, respectively, consistently yielded anomalous Pt and Pd results proximal to mineralization (Coker et al. 1991). At the Stillwater Complex in Montana, twigs of douglas fir trees contained anomalous concentrations of Pt in proximity to known mineralization (Riese and Arp 1986);

2. In the spring, twigs are strongly enriched in Ni and moderately to weakly enriched in Au, Pt and Pd compared to leaves. At Ferguson and Townsend lakes in the NWT, dwarf birch twigs generally contained higher levels of Pd and similar levels of Pt compared to leaves (Rencz and Hall 1992);
3. Ni and Pd occur at higher levels in twigs during the spring. Au occurs at slightly higher levels in twigs during the fall and Pt does not show any consistent shift in concentration between seasons. To our knowledge, this is the first documentation of seasonal variation in Pt and Pd geochemistry within vegetation samples. Clearly, additional work is required;
4. There is no apparent effect related to smelter activity in the twig dataset. Since only spring geochemistry is available for leaves, it is not possible to comment on this dataset. Twig and leaf geochemistry does not increase towards the Falconbridge smelter.

## Summary

The current study has provided useful information regarding Ni-Cu-PGE exploration using surficial geochemical methods. This information can be used not only as an aid to mineral exploration in the Sudbury mining camp but to any Ni-Cu-PGE prospect in the glaciated regions of the world.

Quaternary mapping is essential for the successful implementation of any surficial geochemical survey. Regional and local ice flow patterns must be reconstructed to trace back anomalies to source. Lithostratigraphic units must be identified and linked to their respective ice flow events. An understanding of broad compositional trends of tills and the soils developed on them is necessary so that regional background levels of metals in the surficial environment can be established and threshold limits assigned.

As part of any surficial geochemical survey, it is important to determine whether distinct geochemical populations exist which can be related to variations in local parameters such as bedrock domain, vegetation, aspect and drainage or sediment facies. The Sudbury geochemical datasets were evaluated with respect to these variables to determine whether distinct populations exist. In this case, there did not appear to be enough geochemical variability related to these parameters to warrant the establishment of subpopulations and the determination of threshold anomalies related to each.

Detailed profile sampling was undertaken at several sites within the study area to determine the degree to which surficial weathering processes have altered the geochemical signature of mineral soils present within the region. The ultimate goal of this exercise was to establish which horizon is best suited for programs of Ni-Cu-PGE exploration. In most cases, the Ae- and B-horizons were depleted in metals with respect to the C-horizon due to hydromorphic dispersion of metals held in sulphides as well as the translocation of clay-sized particles downward within the profile. The degree of depletion is highly variable and dependent on local variables such as drainage. The concentration of elements generally increases downward through the C-horizon. This is probably caused by a combination of factors including variations in the primary composition of the unaltered sediment as well as secondary hydromorphic processes. To summarize, the geochemical profiling indicates that there is significant geochemical variation in the upper 1 to 2 m of till in the Sudbury region. For mineral exploration, one should sample the least altered material which usually means sampling at a depth of at least 1 m.

Pathfinder elements for Sudbury-type Ni-Cu-PGE mineralization include the elements Au, Cr, Co, Ag, Pb, As, Se, Sb, Te, Bi, Mn and Fe. This association is best indicated by visual inspection of proportionally-sized dot plots of geochemistry. These elements are generally elevated in the vicinity of known mineralization. Correlation matrices support this observation, although less convincingly. The



correlation of geochemical response between media is generally poor. This is largely attributed to the effects of anthropogenic loading of metals upon the humus geochemical signature. The correlation between the B- and C-horizon datasets is slightly better owing to the similarity of media and the absence of external sources of contamination. The correlation between near-total and partial digestions and within media is generally good. The selective leaches do appear to provide greater contrast between background and anomalous geochemical signatures. Despite its selectivity to the soluble organic fraction of organic soils, the sodium pyrophosphate digestion does not eliminate the effects of smelter emissions. Fulvic and humic acids within these soils quickly scavenge metals bound to amorphous sulphide particles as they are released by surface oxidation.

Natural and anthropogenic geochemical signatures are easily distinguished by visual inspection and comparison of geochemical patterns depicted by the humus and C-horizon geochemical datasets. Clearly the area south of Wanapitei Lake and, to a lesser degree, the eastern half of the study area have been impacted by airborne sources of particulate contamination emanating from the Copper Cliff, Falconbridge and Coniston smelters. Elevated values of, not only Ni, Cu and the PGEs, but all pathfinder elements are clearly displayed by the humus geochemical dataset. The C-horizon geochemical dataset is markedly different and closely linked to the known distribution of mineralization in the Sudbury region. There is no indication that airborne sources of contamination have affected the geochemical response of C-horizon till within the Sudbury region. This is further supported by a comparison of near-total aqua regia and hydroxylamine hydrochloride datasets for B- and C-horizon till datasets. There does not appear to be a greater proportion of weakly bound metals (i.e., those elements held in the oxyhydroxide phases of Mn and Fe) in B- and C-horizon till samples collected in the immediate vicinity of the Falconbridge smelter. There does, however, appear to be an increase in the proportion of weakly bound metals downwards from the B- to the C-horizons, suggesting some degree of hydromorphic dispersion. This phenomenon occurs both in areas under strong influence of atmospheric contamination as well as in more "pristine" areas.

Property-scale sampling was undertaken at 6 selected areas to determine the mineralogical and geochemical fingerprint of mineralization within surficial media. Humus, B- and C-horizon till matrix and the non-magnetic HMC fraction of C-horizon till were sampled and analyzed to determine which medium is best suited for programs of mineral exploration. As mentioned previously, almost half of the study area is strongly influenced by anthropogenic sources of contamination. The geochemical response of humus samples collected from these areas is overwhelmed by this externally-driven signal. Even in areas believed to be relatively unaffected by atmospheric contamination, the humus geochemical response to known mineralization is poor. The response of B- and C- horizon till to known mineralization is much better. The less altered C-horizon exhibits a slightly better response. The non-magnetic HMC of C-horizon till provides higher-contrast geochemical anomalies than the fine fraction ( $-63\ \mu\text{m}$ ) of B- and C-horizon tills. It is our opinion that this higher contrast is not worth the added time and expenses of collecting and analyzing till samples for heavy mineral processing and geochemistry. Dispersal trains of Pt and Pd tend to be short (less than a few hundred metres) whereas those for Ni and Cu are longer, commonly ranging between 500 and 2000 m in length. Thus sampling programs should be designed appropriately.

Ultra-high density sampling at 5 to 20 m intervals over known showings produced spurious results. At the Parkin Offset site, only a small proportion of samples collected showed regionally anomalous geochemical responses. In most cases, the regionally anomalous samples were collected from the till/bedrock interface. At the Barnet showing, topography appears to have affected the geochemical response resulting in hydromorphic anomalies in low-lying areas surrounding mineralization. In both case studies, a sample spacing of 20 m would likely have detected mineralization. In areas of very thin till cover ( $<1\ \text{m}$ ), as at the Barnet property, humus and B-horizon till provide the best response. In areas of thicker till cover (1-2 m), as at the Parkin Offset, C-horizon till provides the strongest response.

The regional sampling program has provided valuable information regarding the background concentration of pebbles, indicator minerals and elements in the surficial environment. The pebble data suggest that most tills reflect local variations in bedrock composition. Till samples that contain a high proportion of distally-derived clasts also contain a local component supporting their use as a sampling medium for drift prospecting programs. Heavy minerals within till also respond to local variations in



bedrock composition. Tills collected over mafic and ultramafic host rocks contain the highest proportions of heavy minerals. The proportion of magnetic minerals within the HMC is highest over the SIC as well as locally over the Levack Gneissic Complex where the tills are charged with diabasic clasts. The Au grain content of till is highest over Archean supracrustal rocks in Parkin and Norman townships. Elevated background levels of Au grains occur over Levack and northern Dowling townships in response to the erosion and dispersion of Au from the Benny greenstone belt, 10 to 20 km to the northwest.

Aside from providing information on background levels of metals in the surficial environment, the regional geochemical datasets have identified a number of exploration targets. Geochemical anomalies associated with mineralized sublayer, offset dikes and footwall-type mineralization have been recognized in all of the geochemical datasets. As mentioned previously, the humus geochemical dataset is strongly impacted by anthropogenic sources of contamination including smelting activity and infrastructure development in close proximity to mining and milling facilities. Within these areas of intense metal loading, one can detect a weak signal related to mineralization. These anomalies are best defined by the sodium pyrophosphate dataset. The B- and C-horizon till and HMC geochemical datasets are similar to each other in many respects. In all cases, strong geochemical anomalies occur in areas of mineralized sublayer and mineralized offset dikes. A number of untested anomalies also exist both within the Sudbury basin as well as within the footwall rocks to the north. All of these should be investigated to determine their significance.

A pilot project of biogeochemistry was employed along the eastern margin of the study area to determine whether this technique is viable for programs of mineral exploration in the Sudbury mining camp. No apparent correlation was observed between birch leaf and/or twig geochemistry and the position of mineralized sublayer at the sampling density chosen. A higher density sampling program is required to thoroughly evaluate this technique. Seasonal variation in Pt and Pd content of twigs was observed.

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## **Appendix A. Sample location and site description information.**

### **Bedrock Type:**

1. Chelmsford Formation
2. Onwatin Formation
3. Onaping Formation (Black Member)
4. Onaping Formation (Grey Member)
5. Granophytic Phase (SIC)
6. Transitional Phase (SIC)
7. Noritic Phase (SIC)
8. Levack Gneissic Complex
9. Quartz Diorite in Offset Dikes
10. Huronian Metasediments
11. Nipissing Gabbro and Diabase
12. Mafic Extrusive Rocks
13. Felsic-Intermediate Extrusive Rocks
14. Marble

### **Moraine Type:**

1. Ground Moraine (Lodgement Till)
2. Recessional Moraine (Flow and Meltout Till)
3. Stagnation Moraine (Supraglacial Meltout and Flow Till)

### **B-Horizon Material:**

1. Till
2. Sand, Silt, Clay

### **Tree Type:**

1. Coniferous
2. Deciduous
3. Mixed
4. Cleared

### **Drainage:**

1. Well Drained
2. Moderately Drained
3. Poorly Drained

### **Topographic Setting:**

1. Up Ice
2. Down Ice
3. Crest
4. Valley
5. Flat (No Aspect)



| SAMPLE ID  | Easting<br>(NAD27) | Northing<br>(NAD27) | Humus<br>Sampled | B-Horizon<br>Sampled | C-Horizon Sampled |     | Bedrock<br>Type | Moraine<br>Type | B-Horizon<br>Material | Tree<br>Type | Drainage | Topo<br>Setting |
|------------|--------------------|---------------------|------------------|----------------------|-------------------|-----|-----------------|-----------------|-----------------------|--------------|----------|-----------------|
|            |                    |                     |                  |                      | -63 $\mu$ m       | HMC |                 |                 |                       |              |          |                 |
| 92-AFB-001 | 506260             | 5170500             | YES              | YES                  | YES               | YES | 3               | 2               | 2                     | 2            | 1        | 2               |
| 92-AFB-002 | 510720             | 5175050             | YES              | YES                  | YES               | YES | 8               | 1               | 1                     | 2            | 1        | 2               |
| 92-AFB-003 | 511860             | 5176240             | YES              | YES                  | YES               | YES | 8               | 1               | 1                     | 3            | 2        | 2               |
| 92-AFB-004 | 512660             | 5177300             | YES              | YES                  | NO                | NO  | 8               | 1               | 1                     | 3            | 1        | 1               |
| 92-AFB-005 | 508500             | 5172800             | YES              | YES                  | YES               | NO  | 5               | 1               | 1                     | 3            | 1        | 1               |
| 92-AFB-006 | 512050             | 5167450             | YES              | YES                  | YES               | YES | 5               | 3               | 1                     | 2            | 1        | 3               |
| 92-AFB-007 | 512360             | 5169000             | YES              | YES                  | YES               | YES | 5               | 1               | 1                     | 2            | 1        | 2               |
| 92-AFB-008 | 511560             | 5171640             | YES              | YES                  | NO                | NO  | 8               | 1               | 1                     | 3            | 1        | 2               |
| 92-AFB-009 | 511370             | 5173500             | YES              | YES                  | YES               | YES | 8               | 1               | 1                     | 3            | 1        | 1               |
| 92-AFB-010 | 514780             | 5165725             | YES              | YES                  | NO                | NO  | 5               | 1               | 1                     | 2            | 1        | 1               |
| 92-AFB-011 | 513680             | 5165620             | YES              | YES                  | YES               | YES | 4               | 1               | 1                     | 2            | 1        | 1               |
| 92-AFB-012 | 512900             | 5166200             | YES              | YES                  | YES               | YES | 4               | 1               | 1                     | 2            | 1        | 1               |
| 92-AFB-013 | 516250             | 5166360             | YES              | YES                  | YES               | NO  | 7               | 1               | 1                     | 2            | 1        | 1               |
| 92-AFB-014 | 515975             | 5167150             | YES              | YES                  | YES               | YES | 7               | 1               | 2                     | 2            | 1        | 4               |
| 92-AFB-015 | 515275             | 5167850             | YES              | YES                  | YES               | YES | 8               | 1               | 1                     | 3            | 1        | 2               |
| 92-AFB-016 | 516780             | 5166400             | YES              | YES                  | YES               | YES | 11              | 1               | 1                     | 2            | 1        | 2               |
| 92-AFB-017 | 514650             | 5169250             | YES              | YES                  | YES               | YES | 8               | 1               | 1                     | 3            | 1        | 2               |
| 92-AFB-018 | 516275             | 5168700             | YES              | YES                  | YES               | NO  | 8               | 1               | 1                     | 3            | 2        | 4               |
| 92-AFB-019 | 516820             | 5170080             | YES              | YES                  | YES               | YES | 10              | 1               | 1                     | 3            | 2        | 4               |
| 92-AFB-020 | 516500             | 5171400             | YES              | YES                  | YES               | YES | 10              | 1               | 1                     | 2            | 1        | 1               |
| 92-AFB-021 | 515800             | 5174150             | YES              | YES                  | YES               | YES | 8               | 1               | 1                     | 2            | 1        | 1               |
| 92-AFB-022 | 516460             | 5172500             | YES              | YES                  | YES               | YES | 10              | 1               | 1                     | 2            | 1        | 1               |
| 92-AFB-023 | 522680             | 5170200             | YES              | YES                  | YES               | YES | 11              | 1               | 1                     | 2            | 1        | 1               |
| 92-AFB-024 | 521300             | 5169960             | YES              | YES                  | YES               | YES | 11              | 1               | 1                     | 2            | 1        | 1               |
| 92-AFB-025 | 519700             | 5170360             | YES              | YES                  | YES               | YES | 10              | 1               | 1                     | 3            | 1        | 1               |
| 92-AFB-026 | 519330             | 5169675             | YES              | YES                  | NO                | NO  | 10              | 1               | 1                     | 2            | 1        | 1               |
| 92-AFB-027 | 522050             | 5167650             | YES              | YES                  | YES               | YES | 11              | 1               | 1                     | 3            | 1        | 2               |
| 92-AFB-028 | 518650             | 5165200             | YES              | YES                  | YES               | YES | 11              | 1               | 1                     | 2            | 1        | 3               |
| 92-AFB-029 | 520150             | 5165060             | YES              | YES                  | YES               | YES | 10              | 1               | 1                     | 2            | 1        | 1               |
| 92-AFB-030 | 518600             | 5163550             | YES              | YES                  | NO                | NO  | 10              | 2               | 1                     | 2            | 1        | 1               |
| 92-AFB-031 | 519660             | 5166600             | YES              | YES                  | YES               | YES | 11              | 1               | 1                     | 2            | 1        | 2               |
| 92-AFB-032 | 494525             | 5171750             | YES              | YES                  | YES               | YES | 3               | 1               | 1                     | 2            | 1        | 2               |
| 92-AFB-033 | 495460             | 5173400             | YES              | YES                  | YES               | YES | 3               | 1               | 1                     | 2            | 1        | 2               |
| 92-AFB-034 | 494525             | 5172040             | YES              | YES                  | YES               | YES | 3               | 2               | 1                     | 2            | 1        | 3               |
| 92-AFB-035 | 493080             | 5172600             | YES              | YES                  | NO                | NO  | 3               | 1               | 1                     | 2            | 1        | 2               |
| 92-AFB-036 | 492750             | 5171500             | YES              | YES                  | YES               | YES | 3               | 2               | 1                     | 2            | 1        | 3               |
| 92-AFB-037 | 490650             | 5172925             | YES              | YES                  | YES               | YES | 5               | 1               | 1                     | 3            | 1        | 1               |
| 92-AFB-038 | 490225             | 5173875             | YES              | YES                  | YES               | YES | 5               | 1               | 1                     | 3            | 1        | 1               |
| 92-AFB-039 | 497425             | 5172650             | YES              | YES                  | YES               | YES | 3               | 1               | 1                     | 2            | 1        | 3               |
| 92-AFB-040 | 495200             | 5176240             | YES              | YES                  | YES               | YES | 5               | 1               | 2                     | 2            | 1        | 2               |
| 92-AFB-041 | 494650             | 5176460             | YES              | YES                  | YES               | YES | 5               | 1               | 1                     | 3            | 1        | 2               |
| 92-AFB-042 | 493975             | 5178000             | YES              | YES                  | NO                | NO  | 8               | 1               | 1                     | 3            | 2        | 1               |
| 92-AFB-043 | 493640             | 5179180             | YES              | YES                  | YES               | YES | 8               | 3               | 1                     | 3            | 1        | 1               |
| 92-AFB-044 | 492820             | 5179675             | YES              | YES                  | YES               | YES | 8               | 1               | 1                     | 3            | 1        | 1               |
| 92-AFB-045 | 497450             | 5173925             | YES              | YES                  | NO                | NO  | 4               | 1               | 1                     | 3            | 1        | 1               |
| 92-AFB-046 | 496900             | 5174400             | YES              | YES                  | NO                | NO  | 4               | 1               | 1                     | 3            | 1        | 1               |
| 92-AFB-047 | 496200             | 5175750             | YES              | YES                  | YES               | YES | 5               | 1               | 1                     | 3            | 1        | 1               |
| 92-AFB-048 | 492000             | 5180200             | YES              | YES                  | YES               | YES | 8               | 1               | 1                     | 3            | 2        | 1               |
| 92-AFB-049 | 490550             | 5180800             | YES              | YES                  | YES               | YES | 8               | 1               | 1                     | 3            | 1        | 1               |
| 92-AFB-050 | 491920             | 5181710             | YES              | YES                  | YES               | YES | 8               | 1               | 1                     | 3            | 1        | 3               |
| 92-AFB-051 | 495000             | 5174200             | YES              | YES                  | YES               | YES | 4               | 1               | 1                     | 3            | 1        | 2               |
| 92-AFB-052 | 492010             | 5174100             | YES              | YES                  | YES               | YES | 5               | 1               | 2                     | 2            | 1        | 1               |
| 92-AFB-053 | 490600             | 5175500             | YES              | YES                  | NO                | NO  | 7               | 1               | 1                     | 3            | 2        | 2               |
| 92-AFB-054 | 489950             | 5176300             | YES              | YES                  | NO                | NO  | 9               | 1               | 1                     | 3            | 2        | 2               |
| 92-AFB-055 | 501325             | 5172700             | YES              | YES                  | YES               | YES | 3               | 2               | 1                     | 2            | 2        | 1               |
| 92-AFB-056 | 500700             | 5173250             | YES              | YES                  | YES               | YES | 3               | 1               | 1                     | 2            | 1        | 1               |
| 92-AFB-057 | 502160             | 5173400             | YES              | YES                  | NO                | NO  | 3               | 1               | 1                     | 2            | 2        | 4               |
| 92-AFB-058 | 491080             | 5171150             | YES              | YES                  | YES               | YES | 3               | 1               | 2                     | 3            | 1        | 1               |
| 92-AFB-059 | 506800             | 5181600             | YES              | YES                  | YES               | YES | 8               | 1               | 2                     | 4            | 2        | 2               |
| 92-AFB-060 | 509150             | 5183050             | YES              | YES                  | YES               | YES | 9               | 1               | 1                     | 1            | 2        | 3               |
| 92-AFB-061 | 509155             | 5183950             | YES              | YES                  | YES               | YES | 12              | 1               | 1                     | 1            | 2        | 1               |
| 92-AFB-062 | 509100             | 5182900             | YES              | YES                  | YES               | YES | 9               | 1               | 1                     | 3            | 2        | 1               |
| 92-AFB-063 | 509350             | 5180900             | YES              | YES                  | YES               | YES | 8               | 1               | 1                     | 3            | 2        | 2               |
| 92-AFB-064 | 507100             | 5179260             | YES              | YES                  | YES               | YES | 7               | 1               | 2                     | 2            | 1        | 3               |

| SAMPLE ID  | Easting<br>(NAD27) | Northing<br>(NAD27) | Humus<br>Sampled | B-Horizon<br>Sampled | C-Horizon Sampled |     | Bedrock<br>Type | Moraine<br>Type | B-Horizon<br>Material | Tree<br>Type | Drainage | Topo<br>Setting |
|------------|--------------------|---------------------|------------------|----------------------|-------------------|-----|-----------------|-----------------|-----------------------|--------------|----------|-----------------|
|            |                    |                     |                  |                      | -63 µm            | HMC |                 |                 |                       |              |          |                 |
| 92-AFB-065 | 507250             | 5178425             | YES              | YES                  | YES               | YES | 5               | 1               | 2                     | 3            | 2        | 1               |
| 92-AFB-066 | 507360             | 5177340             | YES              | YES                  | YES               | YES | 5               | 1               | 1                     | 3            | 1        | 1               |
| 92-AFB-067 | 507480             | 5175850             | YES              | YES                  | YES               | YES | 5               | 1               | 1                     | 3            | 1        | 1               |
| 92-AFB-068 | 464340             | 5162500             | YES              | YES                  | YES               | YES | 8               | 3               | 2                     | 3            | 2        | 2               |
| 92-AFB-069 | 464400             | 5161360             | YES              | YES                  | YES               | YES | 8               | 3               | 1                     | 2            | 2        | 2               |
| 92-AFB-070 | 463600             | 5160440             | YES              | YES                  | NO                | NO  | 8               | 1               | 1                     | 2            | 2        | 1               |
| 92-AFB-071 | 462260             | 5160900             | YES              | YES                  | YES               | YES | 8               | 1               | 1                     | 3            | 2        | 1               |
| 92-AFB-072 | 462500             | 5159350             | YES              | YES                  | YES               | YES | 8               | 1               | 1                     | 3            | 1        | 1               |
| 92-AFB-073 | 460800             | 5161550             | YES              | YES                  | YES               | YES | 8               | 1               | 1                     | 1            | 1        | 1               |
| 92-AFB-074 | 458275             | 5162100             | YES              | YES                  | YES               | YES | 8               | 3               | 1                     | 3            | 2        | 1               |
| 92-AFB-075 | 456475             | 5163200             | YES              | YES                  | YES               | YES | 8               | 1               | 1                     | 3            | 1        | 2               |
| 92-AFB-076 | 458650             | 5159600             | YES              | YES                  | YES               | YES | 8               | 3               | 1                     | 3            | 1        | 2               |
| 92-AFB-077 | 458460             | 5158400             | YES              | YES                  | YES               | YES | 8               | 3               | 1                     | 3            | 1        | 2               |
| 92-AFB-078 | 458880             | 5157825             | YES              | YES                  | YES               | YES | 8               | 1               | 1                     | 2            | 1        | 1               |
| 92-AFB-079 | 459100             | 5154810             | YES              | YES                  | YES               | YES | 8               | 1               | 1                     | 2            | 1        | 1               |
| 92-AFB-080 | 461610             | 5153750             | YES              | YES                  | YES               | YES | 5               | 3               | 1                     | 2            | 1        | 1               |
| 92-AFB-081 | 458700             | 5156750             | YES              | YES                  | YES               | YES | 8               | 1               | 1                     | 1            | 1        | 1               |
| 92-AFB-082 | 459220             | 5155850             | YES              | YES                  | YES               | YES | 8               | 3               | 1                     | 3            | 1        | 1               |
| 92-AFB-083 | 459160             | 5153450             | YES              | YES                  | YES               | YES | 8               | 1               | 1                     | 3            | 1        | 3               |
| 92-AFB-084 | 459460             | 5150500             | YES              | YES                  | YES               | YES | 6               | 3               | 1                     | 2            | 1        | 2               |
| 92-AFB-085 | 461000             | 5150925             | YES              | YES                  | YES               | YES | 5               | 1               | 1                     | 2            | 1        | 1               |
| 92-AFB-086 | 460475             | 5151650             | YES              | YES                  | YES               | YES | 5               | 3               | 1                     | 2            | 1        | 1               |
| 92-AFB-087 | 459600             | 5148710             | YES              | YES                  | YES               | YES | 7               | 1               | 2                     | 3            | 1        | 1               |
| 92-AFB-088 | 458450             | 5148600             | YES              | YES                  | YES               | YES | 8               | 3               | 1                     | 2            | 1        | 1               |
| 92-AFB-089 | 459510             | 5146400             | YES              | YES                  | YES               | YES | 6               | 1               | 1                     | 3            | 1        | 1               |
| 92-AFB-090 | 470650             | 5166800             | YES              | YES                  | YES               | YES | 8               | 1               | 1                     | 2            | 1        | 1               |
| 92-AFB-091 | 469700             | 5167400             | YES              | YES                  | YES               | YES | 8               | 1               | 1                     | 2            | 1        | 1               |
| 92-AFB-092 | 471350             | 5167950             | YES              | YES                  | YES               | YES | 8               | 1               | 1                     | 3            | 1        | 1               |
| 92-AFB-093 | 472560             | 5168300             | YES              | YES                  | YES               | YES | 7               | 1               | 2                     | 2            | 1        | 2               |
| 92-AFB-094 | 472810             | 5168460             | YES              | YES                  | YES               | YES | 7               | 1               | 1                     | 2            | 1        | 2               |
| 92-AFB-095 | 473400             | 5168875             | YES              | YES                  | YES               | YES | 7               | 1               | 1                     | 2            | 1        | 2               |
| 92-AFB-096 | 474000             | 5169400             | YES              | YES                  | YES               | YES | 8               | 1               | 1                     | 2            | 1        | 2               |
| 92-AFB-097 | 470400             | 5171300             | YES              | YES                  | YES               | YES | 8               | 2               | 1                     | 3            | 1        | 2               |
| 92-AFB-098 | 470100             | 5163850             | YES              | YES                  | YES               | YES | 6               | 1               | 2                     | 3            | 2        | 2               |
| 92-AFB-099 | 470650             | 5164100             | YES              | YES                  | YES               | YES | 6               | 1               | 1                     | 3            | 1        | 2               |
| 92-AFB-100 | 471160             | 5164650             | YES              | YES                  | YES               | YES | 6               | 1               | 1                     | 3            | 2        | 2               |
| 92-AFB-101 | 471600             | 5165075             | YES              | YES                  | YES               | YES | 6               | 1               | 1                     | 3            | 1        | 1               |
| 92-AFB-102 | 472700             | 5164700             | YES              | YES                  | YES               | YES | 5               | 1               | 1                     | 3            | 2        | 2               |
| 92-AFB-103 | 473200             | 5165500             | YES              | YES                  | YES               | YES | 5               | 1               | 2                     | 3            | 1        | 1               |
| 92-AFB-104 | 472950             | 5166700             | YES              | YES                  | YES               | YES | 5               | 1               | 1                     | 1            | 1        | 1               |
| 92-AFB-105 | 473550             | 5166660             | YES              | YES                  | YES               | YES | 5               | 1               | 1                     | 2            | 1        | 1               |
| 92-AFB-106 | 473750             | 5167900             | YES              | YES                  | YES               | YES | 6               | 1               | 1                     | 2            | 1        | 2               |
| 92-AFB-107 | 472980             | 5168300             | YES              | YES                  | YES               | YES | 7               | 1               | 1                     | 2            | 1        | 1               |
| 92-AFB-108 | 472925             | 5167350             | YES              | YES                  | YES               | YES | 6               | 1               | 1                     | 2            | 1        | 4               |
| 92-AFB-109 | 473950             | 5164550             | YES              | YES                  | YES               | YES | 5               | 1               | 1                     | 3            | 1        | 1               |
| 92-AFB-110 | 473950             | 5163650             | YES              | YES                  | YES               | YES | 4               | 1               | 1                     | 2            | 1        | 2               |
| 92-AFB-111 | 474650             | 5167050             | YES              | YES                  | YES               | YES | 5               | 1               | 1                     | 2            | 1        | 1               |
| 92-AFB-112 | 474850             | 5170250             | YES              | YES                  | YES               | YES | 8               | 1               | 1                     | 2            | 1        | 2               |
| 92-AFB-113 | 468950             | 5160750             | YES              | YES                  | YES               | YES | 5               | 3               | 1                     | 4            | 1        | 1               |
| 92-AFB-114 | 467475             | 5161340             | YES              | YES                  | YES               | YES | 5               | 1               | 1                     | 3            | 1        | 3               |
| 92-AFB-115 | 467850             | 5162450             | YES              | YES                  | YES               | YES | 6               | 1               | 2                     | 3            | 1        | 1               |
| 92-AFB-116 | 468980             | 5162925             | YES              | YES                  | YES               | YES | 6               | 1               | 2                     | 2            | 1        | 2               |
| 92-AFB-117 | 468900             | 5161600             | YES              | YES                  | YES               | YES | 5               | 1               | 1                     | 3            | 1        | 2               |
| 92-AFB-118 | 468090             | 5160550             | YES              | YES                  | YES               | YES | 5               | 1               | 1                     | 3            | 1        | 2               |
| 92-AFB-119 | 476000             | 5156120             | YES              | YES                  | YES               | YES | 1               | 1               | 1                     | 3            | 1        | 1               |
| 92-AFB-120 | 467840             | 5156000             | YES              | YES                  | YES               | YES | 3               | 1               | 1                     | 2            | 1        | 1               |
| 92-AFB-121 | 467600             | 5154950             | YES              | YES                  | YES               | YES | 3               | 1               | 1                     | 3            | 1        | 2               |
| 92-AFB-122 | 470600             | 5161250             | YES              | YES                  | YES               | YES | 5               | 1               | 1                     | 3            | 2        | 1               |
| 92-AFB-123 | 469800             | 5166350             | YES              | YES                  | YES               | YES | 8               | 1               | 1                     | 2            | 1        | 1               |
| 92-AFB-124 | 467500             | 5169200             | YES              | YES                  | YES               | YES | 8               | 1               | 2                     | 3            | 1        | 1               |
| 92-AFB-125 | 468910             | 5169325             | YES              | YES                  | YES               | YES | 8               | 1               | 2                     | 3            | 1        | 1               |
| 92-AFB-126 | 468500             | 5170575             | YES              | YES                  | YES               | YES | 8               | 1               | 2                     | 3            | 1        | 2               |
| 92-AFB-127 | 466750             | 5172700             | YES              | YES                  | YES               | YES | 8               | 1               | 1                     | 1            | 1        | 2               |
| 92-AFB-128 | 472820             | 5169125             | YES              | YES                  | YES               | YES | 8               | 1               | 1                     | 2            | 2        | 1               |

| SAMPLE ID  | Easting<br>(NAD27) | Northing<br>(NAD27) | Humus<br>Sampled | B-Horizon<br>Sampled | C-Horizon Sampled |     | Bedrock<br>Type | Moraine<br>Type | B-Horizon<br>Material | Tree<br>Type | Drainage | Topo<br>Setting |
|------------|--------------------|---------------------|------------------|----------------------|-------------------|-----|-----------------|-----------------|-----------------------|--------------|----------|-----------------|
|            |                    |                     |                  |                      | -63 $\mu$ m       | HMC |                 |                 |                       |              |          |                 |
| 92-AFB-129 | 471750             | 5170120             | YES              | YES                  | YES               | YES | 8               | 1               | 1                     | 2            | 1        | 2               |
| 92-AFB-130 | 470000             | 5172030             | YES              | YES                  | YES               | YES | 8               | 1               | 1                     | 4            | 1        | 2               |
| 92-AFB-131 | 481875             | 5168425             | YES              | YES                  | YES               | YES | 4               | 1               | 2                     | 2            | 1        | 1               |
| 92-AFB-132 | 482500             | 5169425             | YES              | YES                  | YES               | YES | 4               | 1               | 1                     | 3            | 1        | 1               |
| 92-AFB-133 | 482300             | 5171050             | YES              | YES                  | YES               | YES | 5               | 1               | 1                     | 1            | 2        | 2               |
| 92-AFB-134 | 483500             | 5171600             | YES              | YES                  | YES               | YES | 5               | 1               | 1                     | 2            | 1        | 1               |
| 92-AFB-135 | 485225             | 5172225             | YES              | YES                  | YES               | YES | 7               | 1               | 1                     | 3            | 2        | 2               |
| 92-AFB-136 | 486760             | 5172600             | YES              | YES                  | YES               | YES | 5               | 1               | 1                     | 3            | 1        | 2               |
| 92-AFB-137 | 479750             | 5169650             | YES              | YES                  | YES               | YES | 5               | 1               | 1                     | 3            | 1        | 1               |
| 92-AFB-138 | 479880             | 5170375             | YES              | YES                  | YES               | YES | 7               | 1               | 1                     | 2            | 1        | 2               |
| 92-AFB-139 | 479550             | 5171000             | YES              | YES                  | YES               | YES | 8               | 1               | 1                     | 2            | 1        | 2               |
| 92-AFB-140 | 480775             | 5171100             | YES              | YES                  | YES               | YES | 8               | 1               | 2                     | 3            | 1        | 1               |
| 92-AFB-141 | 480800             | 5172520             | YES              | YES                  | YES               | YES | 8               | 1               | 1                     | 3            | 1        | 1               |
| 92-AFB-142 | 481325             | 5173625             | YES              | YES                  | YES               | YES | 8               | 1               | 1                     | 3            | 1        | 1               |
| 92-AFB-143 | 481700             | 5174150             | YES              | YES                  | YES               | YES | 8               | 1               | 1                     | 3            | 1        | 1               |
| 92-AFB-144 | 482750             | 5176700             | YES              | YES                  | YES               | YES | 8               | 1               | 1                     | 1            | 1        | 1               |
| 92-AFB-145 | 482550             | 5177420             | YES              | YES                  | YES               | YES | 8               | 1               | 1                     | 3            | 1        | 2               |
| 92-AFB-146 | 481700             | 5178200             | YES              | YES                  | YES               | YES | 8               | 1               | 1                     | 3            | 1        | 2               |
| 92-AFB-147 | 464450             | 5144800             | YES              | YES                  | YES               | YES | 5               | 1               | 1                     | 3            | 2        | 2               |
| 92-AFB-148 | 465250             | 5145450             | YES              | YES                  | YES               | YES | 5               | 1               | 1                     | 2            | 2        | 1               |
| 92-AFB-149 | 466100             | 5146220             | YES              | YES                  | YES               | YES | 5               | 1               | 1                     | 2            | 2        | 3               |
| 92-AFB-150 | 483580             | 5176560             | YES              | YES                  | YES               | YES | 8               | 1               | 1                     | 3            | 2        | 2               |
| 92-AFB-151 | 484980             | 5176450             | YES              | YES                  | YES               | YES | 8               | 1               | 1                     | 3            | 2        | 1               |
| 92-AFB-152 | 486150             | 5177100             | YES              | YES                  | YES               | YES | 9               | 1               | 1                     | 3            | 1        | 2               |
| 92-AFB-153 | 498100             | 5172225             | YES              | YES                  | YES               | YES | 3               | 2               | 1                     | 2            | 1        | 1               |
| 92-AFB-154 | 499550             | 5172725             | YES              | YES                  | YES               | YES | 3               | 1               | 1                     | 3            | 1        | 2               |
| 92-AFB-155 | 500550             | 5173950             | YES              | YES                  | YES               | YES | 3               | 1               | 1                     | 2            | 1        | 2               |
| 92-AFB-156 | 500075             | 5174700             | YES              | YES                  | YES               | YES | 4               | 1               | 1                     | 2            | 1        | 1               |
| 92-AFB-157 | 513175             | 5163550             | YES              | YES                  | YES               | YES | 3               | 1               | 1                     | 1            | 1        | 2               |
| 92-AFB-158 | 503625             | 5171300             | YES              | YES                  | YES               | YES | 2               | 2               | 1                     | 2            | 1        | 3               |
| 92-AFB-159 | 505300             | 5170900             | YES              | YES                  | YES               | YES | 3               | 2               | 1                     | 2            | 1        | 3               |
| 92-AFB-160 | 507870             | 5172850             | YES              | YES                  | YES               | YES | 4               | 1               | 1                     | 2            | 2        | 2               |
| 92-AFB-161 | 507800             | 5173825             | YES              | YES                  | YES               | YES | 4               | 1               | 1                     | 2            | 2        | 2               |
| 92-AFB-162 | 507700             | 5170250             | YES              | YES                  | YES               | YES | 3               | 2               | 1                     | 2            | 1        | 3               |
| 92-AFB-163 | 507700             | 5170770             | YES              | YES                  | YES               | YES | 3               | 2               | 1                     | 2            | 1        | 4               |
| 92-AFB-164 | 503660             | 5173800             | YES              | YES                  | YES               | YES | 3               | 1               | 1                     | 2            | 1        | 4               |
| 92-AFB-165 | 503500             | 5175540             | YES              | YES                  | YES               | YES | 4               | 1               | 2                     | 2            | 1        | 1               |
| 92-AFB-166 | 509450             | 5183460             | YES              | YES                  | YES               | YES | 9               | 1               | 1                     | 3            | 1        | 1               |
| 92-AFB-167 | 509580             | 5183380             | YES              | YES                  | YES               | YES | 12              | 1               | 1                     | 3            | 1        | 1               |
| 92-AFB-168 | 509350             | 5183880             | YES              | YES                  | YES               | YES | 11              | 1               | 1                     | 3            | 1        | 1               |
| 92-AFB-169 | 509760             | 5184140             | YES              | YES                  | YES               | YES | 13              | 1               | 1                     | 3            | 1        | 2               |
| 92-AFB-170 | 510010             | 5184240             | YES              | YES                  | YES               | YES | 9               | 1               | 1                     | 3            | 1        | 3               |
| 92-AFB-171 | 510280             | 5184240             | YES              | YES                  | YES               | YES | 13              | 1               | 1                     | 3            | 1        | 2               |
| 92-AFB-172 | 509810             | 5184800             | YES              | YES                  | YES               | YES | 11              | 1               | 1                     | 2            | 1        | 2               |
| 92-AFB-173 | 509740             | 5185000             | YES              | YES                  | YES               | YES | 11              | 1               | 1                     | 3            | 1        | 1               |
| 92-AFB-174 | 509980             | 5184830             | YES              | YES                  | YES               | YES | 11              | 1               | 1                     | 3            | 1        | 2               |
| 92-AFB-175 | 510130             | 5185000             | YES              | YES                  | YES               | YES | 10              | 1               | 1                     | 3            | 2        | 2               |
| 92-AFB-176 | 510560             | 5184840             | YES              | YES                  | YES               | YES | 10              | 1               | 1                     | 3            | 1        | 2               |
| 92-AFB-177 | 510380             | 5184530             | YES              | YES                  | YES               | YES | 11              | 1               | 1                     | 3            | 1        | 1               |
| 92-AFB-178 | 510720             | 5184350             | YES              | YES                  | YES               | YES | 11              | 1               | 1                     | 3            | 1        | 2               |
| 92-AFB-179 | 510820             | 5184560             | YES              | YES                  | YES               | YES | 10              | 1               | 1                     | 3            | 1        | 1               |
| 92-AFB-180 | 510790             | 5184780             | YES              | YES                  | YES               | YES | 10              | 1               | 1                     | 3            | 1        | 2               |
| 92-AFB-181 | 509700             | 5184370             | YES              | YES                  | YES               | YES | 13              | 1               | 1                     | 3            | 1        | 2               |
| 92-AFB-182 | 509310             | 5183280             | YES              | YES                  | YES               | YES | 9               | 1               | 1                     | 3            | 2        | 3               |
| 92-AFB-183 | 509220             | 5183620             | YES              | YES                  | YES               | YES | 11              | 1               | 1                     | 3            | 1        | 1               |
| 92-AFB-184 | 510000             | 5183940             | YES              | YES                  | YES               | YES | 13              | 1               | 1                     | 3            | 1        | 2               |
| 92-AFB-185 | 509500             | 5184100             | YES              | YES                  | YES               | YES | 12              | 1               | 1                     | 3            | 1        | 2               |
| 92-AFB-186 | 509470             | 5183080             | YES              | YES                  | YES               | YES | 12              | 1               | 1                     | 3            | 1        | 2               |
| 92-AFB-187 | 509600             | 5182970             | YES              | YES                  | YES               | YES | 11              | 1               | 1                     | 3            | 2        | 3               |
| 92-AFB-188 | 509750             | 5182830             | YES              | YES                  | YES               | YES | 12              | 1               | 1                     | 3            | 1        | 1               |
| 92-AFB-189 | 509920             | 5182740             | YES              | YES                  | YES               | YES | 12              | 1               | 1                     | 3            | 1        | 1               |
| 92-AFB-190 | 509910             | 5182530             | YES              | YES                  | YES               | YES | 13              | 1               | 1                     | 2            | 1        | 3               |
| 92-AFB-191 | 509760             | 5182340             | YES              | YES                  | YES               | YES | 8               | 1               | 1                     | 2            | 1        | 2               |
| 92-AFB-192 | 509780             | 5182140             | YES              | YES                  | YES               | YES | 8               | 1               | 1                     | 2            | 1        | 2               |



| SAMPLE ID  | Easting<br>(NAD27) | Northing<br>(NAD27) | Humus<br>Sampled | B-Horizon<br>Sampled | C-Horizon Sampled |     | Bedrock<br>Type | Moraine<br>Type | B-Horizon<br>Material | Tree<br>Type | Drainage | Topo<br>Setting |
|------------|--------------------|---------------------|------------------|----------------------|-------------------|-----|-----------------|-----------------|-----------------------|--------------|----------|-----------------|
|            |                    |                     |                  |                      | -63 µm            | HMC |                 |                 |                       |              |          |                 |
| 92-AFB-193 | 509620             | 5182000             | YES              | YES                  | YES               | YES | 8               | 1               | 1                     | 2            | 1        | 2               |
| 92-AFB-194 | 509150             | 5183050             | NO               | NO                   | YES               | YES | 9               | 1               | 1                     | 1            | 2        | 4               |
| 92-AFB-195 | 509150             | 5183050             | NO               | NO                   | YES               | YES | 9               | 1               | 1                     | 1            | 2        | 4               |
| 92-AFB-196 | 509150             | 5183050             | NO               | NO                   | YES               | YES | 9               | 1               | 1                     | 1            | 2        | 4               |
| 92-AFB-197 | 509150             | 5183050             | NO               | NO                   | YES               | YES | 9               | 1               | 1                     | 1            | 2        | 4               |
| 92-AFB-198 | 482450             | 5177600             | YES              | YES                  | YES               | YES | 8               | 1               | 1                     | 2            | 2        | 1               |
| 92-AFB-199 | 482890             | 5177890             | YES              | YES                  | YES               | YES | 8               | 1               | 1                     | 3            | 1        | 2               |
| 92-AFB-200 | 482620             | 5177900             | YES              | YES                  | YES               | YES | 8               | 1               | 1                     | 3            | 1        | 2               |
| 92-AFB-201 | 482470             | 5177080             | YES              | YES                  | YES               | YES | 8               | 1               | 1                     | 3            | 1        | 2               |
| 92-AFB-202 | 481970             | 5177920             | YES              | YES                  | YES               | YES | 8               | 1               | 1                     | 2            | 1        | 1               |
| 92-AFB-203 | 481980             | 5177780             | YES              | YES                  | YES               | YES | 8               | 1               | 1                     | 3            | 1        | 2               |
| 92-AFB-204 | 481450             | 5178010             | YES              | YES                  | YES               | YES | 8               | 1               | 1                     | 1            | 2        | 1               |
| 92-AFB-205 | 481250             | 5177895             | YES              | YES                  | YES               | YES | 8               | 1               | 1                     | 1            | 1        | 3               |
| 92-AFB-206 | 475030             | 5170320             | YES              | YES                  | YES               | YES | 8               | 1               | 1                     | 2            | 2        | 4               |
| 92-AFB-207 | 475060             | 5170580             | YES              | YES                  | YES               | YES | 8               | 1               | 1                     | 3            | 2        | 2               |
| 92-AFB-208 | 475220             | 5170750             | YES              | YES                  | YES               | YES | 8               | 1               | 1                     | 3            | 2        | 1               |
| 92-AFB-209 | 475040             | 5169800             | YES              | YES                  | YES               | YES | 7               | 1               | 1                     | 3            | 1        | 2               |
| 92-AFB-210 | 474700             | 5170170             | YES              | YES                  | NO                | NO  | 8               | 1               | 1                     | 2            | 1        | 2               |
| 92-AFB-211 | 474700             | 5170190             | YES              | YES                  | YES               | YES | 8               | 1               | 1                     | 2            | 1        | 2               |
| 92-AFB-212 | 474700             | 5170210             | YES              | YES                  | YES               | YES | 8               | 1               | 1                     | 2            | 1        | 2               |
| 92-AFB-213 | 474700             | 5170235             | YES              | YES                  | NO                | NO  | 8               | 1               | 1                     | 2            | 1        | 2               |
| 92-AFB-214 | 474700             | 5170255             | YES              | YES                  | NO                | NO  | 8               | 1               | 1                     | 2            | 1        | 2               |
| 92-AFB-215 | 474713             | 5170270             | YES              | YES                  | YES               | NO  | 8               | 1               | 1                     | 2            | 1        | 3               |
| 92-AFB-216 | 474733             | 5170293             | YES              | YES                  | YES               | YES | 8               | 1               | 1                     | 2            | 1        | 3               |
| 92-AFB-217 | 474746             | 5170308             | YES              | YES                  | YES               | YES | 8               | 1               | 1                     | 2            | 1        | 3               |
| 92-AFB-218 | 474759             | 5170323             | YES              | YES                  | YES               | YES | 8               | 1               | 1                     | 2            | 1        | 3               |
| 92-AFB-219 | 474776             | 5170344             | YES              | YES                  | YES               | YES | 8               | 1               | 1                     | 2            | 1        | 3               |
| 92-AFB-220 | 474784             | 5170354             | YES              | YES                  | NO                | NO  | 8               | 1               | 1                     | 2            | 1        | 3               |
| 92-AFB-221 | 474797             | 5170369             | YES              | YES                  | YES               | NO  | 8               | 1               | 1                     | 2            | 1        | 3               |
| 92-AFB-222 | 474823             | 5170384             | YES              | YES                  | YES               | YES | 8               | 1               | 1                     | 2            | 1        | 1               |
| 92-AFB-223 | 474840             | 5170394             | YES              | YES                  | NO                | NO  | 8               | 1               | 1                     | 2            | 1        | 1               |
| 92-AFB-224 | 474650             | 5169430             | YES              | YES                  | YES               | YES | 7               | 1               | 1                     | 2            | 1        | 1               |
| 92-AFB-225 | 474680             | 5169580             | YES              | YES                  | YES               | YES | 7               | 1               | 1                     | 2            | 1        | 1               |
| 92-AFB-226 | 474320             | 5169660             | YES              | YES                  | YES               | YES | 8               | 1               | 1                     | 2            | 1        | 2               |
| 92-AFB-227 | 474550             | 5169980             | YES              | YES                  | YES               | YES | 8               | 1               | 1                     | 3            | 1        | 2               |
| 92-AFB-228 | 474780             | 5169880             | YES              | YES                  | YES               | YES | 8               | 1               | 2                     | 3            | 2        | 4               |
| 92-AFB-229 | 474800             | 5170500             | YES              | YES                  | NO                | NO  | 8               | 1               | 1                     | 2            | 2        | 2               |
| 92-AFB-230 | 474610             | 5170460             | YES              | YES                  | NO                | NO  | 8               | 1               | 1                     | 2            | 2        | 1               |
| 92-AFB-231 | 474600             | 5170360             | YES              | YES                  | NO                | NO  | 8               | 1               | 1                     | 2            | 2        | 3               |
| 92-AFB-232 | 474640             | 5170280             | YES              | YES                  | NO                | NO  | 8               | 1               | 1                     | 2            | 1        | 3               |
| 92-AFB-233 | 474780             | 5170400             | YES              | YES                  | YES               | NO  | 8               | 1               | 1                     | 2            | 1        | 3               |
| 92-AFB-234 | 474830             | 5170300             | YES              | YES                  | NO                | NO  | 8               | 1               | 1                     | 2            | 1        | 3               |
| 93-AFB-001 | 510700             | 5184900             | NO               | NO                   | YES               | YES | 14              | 1               | na                    | 3            | 2        | 2               |
| 93-AFB-002 | 509650             | 5185850             | YES              | YES                  | YES               | YES | 10              | 2               | 1                     | 3            | 1        | 2               |
| 93-AFB-003 | 509150             | 5185600             | YES              | YES                  | YES               | YES | 10              | 1               | 1                     | 3            | 1        | 2               |
| 93-AFB-004 | 508550             | 5185200             | YES              | YES                  | YES               | YES | 10              | 1               | 1                     | 4            | 1        | 1               |
| 93-AFB-005 | 508500             | 5185100             | NO               | NO                   | YES               | YES | 10              | 1               | na                    | 4            | 2        | 2               |
| 93-AFB-006 | 509150             | 5186300             | YES              | YES                  | YES               | YES | 10              | 1               | 1                     | 2            | 3        | 2               |
| 93-AFB-007 | 509600             | 5186200             | YES              | YES                  | YES               | YES | 10              | 1               | 1                     | 3            | 1        | 1               |
| 93-AFB-008 | 508600             | 5185850             | YES              | YES                  | YES               | YES | 10              | 1               | 1                     | 1            | 2        | 5               |
| 93-AFB-009 | 508050             | 5186650             | NO               | NO                   | YES               | YES | 14              | 2               | na                    | 4            | 1        | 2               |
| 93-AFB-010 | 510650             | 5185900             | YES              | YES                  | YES               | YES | 10              | 3               | 1                     | 1            | 1        | 1               |
| 93-AFB-011 | 508850             | 5185200             | YES              | YES                  | YES               | YES | 12              | 1               | 1                     | 4            | 1        | 1               |
| 93-AFB-012 | 508600             | 5184950             | NO               | YES                  | YES               | YES | 12              | 1               | 1                     | 4            | 2        | 1               |
| 93-AFB-013 | 508650             | 5185200             | NO               | YES                  | YES               | YES | 12              | 2               | 1                     | 4            | 2        | 2               |
| 93-AFB-014 | 510050             | 5182100             | YES              | YES                  | YES               | YES | 12              | 1               | 1                     | 3            | 1        | 2               |
| 93-AFB-015 | 510250             | 5181950             | YES              | YES                  | YES               | YES | 12              | 1               | 1                     | 3            | 1        | 3               |
| 93-AFB-016 | 510100             | 5181800             | YES              | YES                  | YES               | YES | 12              | 1               | 1                     | 1            | 1        | 3               |
| 93-AFB-017 | 509600             | 5183750             | YES              | YES                  | YES               | YES | 12              | 3               | 1                     | 1            | 2        | 5               |
| 93-AFB-018 | 509650             | 5183550             | YES              | YES                  | YES               | YES | 12              | 3               | 1                     | 1            | 2        | 5               |
| 93-AFB-019 | 509800             | 5183300             | YES              | YES                  | YES               | YES | 12              | 3               | 1                     | 1            | 2        | 5               |
| 93-AFB-020 | 510000             | 5183100             | YES              | YES                  | YES               | YES | 12              | 1               | 1                     | 1            | 1        | 1               |
| 93-AFB-021 | 510000             | 5183600             | YES              | YES                  | YES               | YES | 12              | 3               | 1                     | 1            | 1        | 1               |
| 93-AFB-022 | 510050             | 5183050             | YES              | YES                  | YES               | YES | 12              | 1               | 1                     | 1            | 1        | 1               |

| SAMPLE ID  | Easting<br>(NAD27) | Northing<br>(NAD27) | Humus<br>Sampled | B-Horizon<br>Sampled | C-Horizon Sampled |     | Bedrock<br>Type | Moraine<br>Type | B-Horizon<br>Material | Tree<br>Type | Drainage | Topo<br>Setting |
|------------|--------------------|---------------------|------------------|----------------------|-------------------|-----|-----------------|-----------------|-----------------------|--------------|----------|-----------------|
|            |                    |                     |                  |                      | -63 $\mu$ m       | HMC |                 |                 |                       |              |          |                 |
| 93-AFB-023 | 509050             | 5184250             | YES              | YES                  | YES               | YES | 12              | 1               | 1                     | 3            | 2        | 2               |
| 93-AFB-024 | 509550             | 5184700             | NO               | YES                  | YES               | YES | 12              | 1               | 1                     | 4            | 1        | 1               |
| 93-AFB-025 | 509850             | 5186100             | YES              | YES                  | YES               | YES | 10              | 2               | 1                     | 3            | 1        | 1               |
| 93-AFB-026 | 510300             | 5182550             | YES              | YES                  | YES               | YES | 12              | 1               | 1                     | 1            | 1        | 5               |
| 93-AFB-027 | 512600             | 5168750             | YES              | YES                  | YES               | YES | 5               | 1               | 1                     | 3            | 1        | 5               |
| 93-AFB-028 | 513250             | 5168150             | YES              | YES                  | YES               | YES | 5               | 1               | 1                     | 3            | 1        | 1               |
| 93-AFB-029 | 514850             | 5167850             | YES              | YES                  | YES               | YES | 7               | 1               | 1                     | 2            | 1        | 1               |
| 93-AFB-030 | 510300             | 5173850             | YES              | YES                  | YES               | YES | 7               | 1               | 1                     | 2            | 1        | 2               |
| 93-AFB-031 | 510700             | 5172250             | YES              | YES                  | YES               | YES | 7               | 1               | 1                     | 3            | 1        | 1               |
| 93-AFB-032 | 510050             | 5171050             | YES              | YES                  | YES               | YES | 5               | 3               | 1                     | 2            | 1        | 1               |
| 93-AFB-033 | 511550             | 5168700             | YES              | YES                  | YES               | YES | 5               | 1               | 1                     | 2            | 1        | 3               |
| 93-AFB-034 | 510800             | 5169100             | YES              | YES                  | YES               | YES | 5               | 2               | 1                     | 2            | 1        | 2               |
| 93-AFB-035 | 512950             | 5169600             | YES              | YES                  | YES               | YES | 6               | 1               | 1                     | 2            | 1        | 2               |
| 93-AFB-036 | 499000             | 5175150             | YES              | YES                  | YES               | YES | 5               | 1               | 1                     | 3            | 1        | 1               |
| 93-AFB-037 | 498550             | 5175350             | YES              | YES                  | YES               | YES | 5               | 1               | 2                     | 1            | 1        | 1               |
| 93-AFB-038 | 497800             | 5176550             | YES              | YES                  | YES               | YES | 5               | 3               | 1                     | 1            | 1        | 1               |
| 93-AFB-039 | 499975             | 5175550             | YES              | YES                  | YES               | YES | 5               | 2               | 1                     | 4            | 1        | 2               |
| 93-AFB-040 | 499345             | 5173850             | YES              | YES                  | YES               | YES | 4               | 1               | 1                     | 2            | 1        | 1               |
| 93-AFB-041 | 493625             | 5174500             | YES              | YES                  | YES               | YES | 5               | 1               | 1                     | 3            | 1        | 2               |
| 93-AFB-042 | 493050             | 5175450             | YES              | YES                  | YES               | YES | 5               | 1               | 1                     | 3            | 1        | 1               |
| 93-AFB-043 | 491500             | 5174350             | YES              | YES                  | YES               | YES | 5               | 2               | 1                     | 3            | 1        | 4               |
| 93-AFB-044 | 491700             | 5175400             | YES              | YES                  | YES               | YES | 5               | 1               | 1                     | 3            | 1        | 1               |
| 93-AFB-045 | 499300             | 5169100             | YES              | YES                  | YES               | YES | 1               | 1               | 2                     | 2            | 2        | 2               |
| 93-AFB-046 | 472050             | 5164000             | YES              | YES                  | YES               | YES | 5               | 1               | 1                     | 3            | 1        | 2               |
| 93-AFB-047 | 472050             | 5163750             | YES              | YES                  | YES               | YES | 5               | 1               | 1                     | 2            | 1        | 2               |
| 93-AFB-048 | 472650             | 5164500             | YES              | YES                  | YES               | YES | 5               | 1               | 1                     | 3            | 1        | 1               |
| 93-AFB-049 | 523050             | 5167750             | YES              | YES                  | YES               | YES | 11              | 1               | 1                     | 3            | 1        | 2               |
| 93-AFB-050 | 522150             | 5168350             | YES              | YES                  | YES               | YES | 11              | 1               | 1                     | 3            | 1        | 1               |
| 93-AFB-051 | 474400             | 5165700             | YES              | YES                  | YES               | YES | 5               | 1               | 1                     | 3            | 1        | 1               |
| 93-AFB-052 | 475150             | 5166150             | YES              | YES                  | YES               | YES | 5               | 3               | 1                     | 3            | 1        | 2               |
| 93-AFB-053 | 475500             | 5165950             | YES              | YES                  | YES               | YES | 5               | 2               | 1                     | 3            | 1        | 1               |
| 93-AFB-054 | 476050             | 5166300             | YES              | YES                  | YES               | YES | 5               | 1               | 1                     | 3            | 1        | 1               |
| 93-AFB-055 | 458100             | 5148050             | YES              | YES                  | YES               | YES | 8               | 1               | 1                     | 4            | 2        | 1               |
| 93-AFB-056 | 458650             | 5147450             | YES              | YES                  | YES               | YES | 8               | 1               | 1                     | 2            | 1        | 1               |
| 93-AFB-057 | 461000             | 5150600             | YES              | YES                  | YES               | YES | 5               | 1               | 1                     | 3            | 2        | 1               |
| 93-AFB-058 | 460050             | 5151450             | YES              | YES                  | YES               | YES | 5               | 1               | 1                     | 3            | 1        | 5               |
| 93-AFB-059 | 458250             | 5153450             | YES              | YES                  | NO                | NO  | 8               | 1               | 1                     | 3            | 1        | 2               |
| 93-AFB-060 | 457300             | 5153300             | YES              | YES                  | YES               | NO  | 8               | 1               | 2                     | 3            | 1        | 2               |
| 93-AFB-061 | 460150             | 5154250             | YES              | YES                  | YES               | YES | 7               | 1               | 2                     | 3            | 1        | 1               |
| 93-AFB-062 | 458350             | 5155200             | YES              | YES                  | YES               | YES | 8               | 3               | 1                     | 1            | 1        | 2               |
| 93-AFB-063 | 459600             | 5157750             | YES              | YES                  | YES               | YES | 8               | 3               | 1                     | 1            | 1        | 2               |
| 93-AFB-064 | 460450             | 5157500             | YES              | YES                  | YES               | YES | 8               | 1               | 1                     | 3            | 2        | 2               |
| 93-AFB-065 | 461300             | 5157350             | YES              | YES                  | YES               | YES | 8               | 1               | 1                     | 3            | 1        | 2               |
| 93-AFB-066 | 460900             | 5156200             | YES              | YES                  | YES               | YES | 8               | 1               | 1                     | 3            | 1        | 1               |
| 93-AFB-067 | 513250             | 5176850             | YES              | YES                  | NO                | NO  | 8               | 1               | 1                     | 3            | 2        | 1               |
| 93-AFB-068 | 513400             | 5175600             | YES              | YES                  | YES               | YES | 8               | 1               | 1                     | 1            | 2        | 1               |
| 93-AFB-069 | 513750             | 5173950             | YES              | YES                  | YES               | YES | 8               | 1               | 1                     | 3            | 1        | 1               |
| 93-AFB-070 | 512200             | 5175750             | YES              | YES                  | YES               | YES | 8               | 1               | 1                     | 3            | 1        | 2               |
| 93-AFB-071 | 515050             | 5174350             | YES              | YES                  | YES               | YES | 8               | 3               | 1                     | 3            | 1        | 1               |
| 93-AFB-072 | 522300             | 5171050             | YES              | YES                  | NO                | NO  | 10              | 1               | 1                     | 3            | 2        | 1               |
| 93-AFB-073 | 521550             | 5172650             | YES              | YES                  | YES               | YES | 10              | 1               | 1                     | 2            | 1        | 2               |
| 93-AFB-074 | 519850             | 5171550             | YES              | YES                  | YES               | YES | 10              | 1               | 1                     | 2            | 2        | 2               |
| 93-AFB-075 | 458800             | 5155300             | YES              | YES                  | YES               | YES | 8               | 1               | 1                     | 3            | 1        | 2               |
| 93-AFB-076 | 457650             | 5155650             | YES              | YES                  | YES               | YES | 8               | 1               | 1                     | 1            | 1        | 2               |
| 93-AFB-077 | 456850             | 5156150             | YES              | YES                  | YES               | YES | 8               | 1               | 1                     | 1            | 1        | 2               |
| 93-AFB-078 | 458800             | 5154150             | YES              | YES                  | NO                | NO  | 8               | 1               | 1                     | 3            | 1        | 1               |
| 93-AFB-079 | 457600             | 5159550             | YES              | YES                  | YES               | YES | 8               | 1               | 1                     | 3            | 1        | 1               |
| 93-AFB-080 | 456950             | 5158350             | YES              | YES                  | YES               | YES | 8               | 1               | 1                     | 3            | 1        | 2               |
| 93-AFB-081 | 456900             | 5157700             | YES              | YES                  | YES               | YES | 8               | 2               | 1                     | 3            | 1        | 2               |
| 93-AFB-082 | 457500             | 5156850             | YES              | YES                  | YES               | YES | 8               | 2               | 1                     | 1            | 1        | 2               |
| 93-AFB-083 | 457750             | 5155000             | YES              | YES                  | YES               | NO  | 8               | 1               | 1                     | 3            | 1        | 2               |
| 93-AFB-084 | 457300             | 5155350             | YES              | YES                  | YES               | YES | 8               | 1               | 1                     | 1            | 1        | 2               |
| 93-AFB-085 | 456550             | 5155550             | YES              | YES                  | YES               | YES | 8               | 3               | 1                     | 2            | 1        | 2               |
| 93-AFB-086 | 463300             | 5158700             | YES              | YES                  | YES               | YES | 7               | 3               | 1                     | 2            | 1        | 1               |



| SAMPLE ID  | Easting<br>(NAD27) | Northing<br>(NAD27) | Humus<br>Sampled | B-Horizon<br>Sampled | C-Horizon Sampled |     | Bedrock<br>Type | Moraine<br>Type | B-Horizon<br>Material | Tree<br>Type | Drainage | Topo<br>Setting |
|------------|--------------------|---------------------|------------------|----------------------|-------------------|-----|-----------------|-----------------|-----------------------|--------------|----------|-----------------|
|            |                    |                     |                  |                      | -63 µm            | HMC |                 |                 |                       |              |          |                 |
| 93-AFB-087 | 464050             | 5158500             | YES              | YES                  | YES               | YES | 6               | 1               | 1                     | 3            | 1        | 2               |
| 93-AFB-088 | 465150             | 5158750             | YES              | YES                  | YES               | YES | 5               | 1               | 1                     | 2            | 1        | 1               |
| 93-AFB-089 | 466100             | 5158800             | YES              | YES                  | YES               | YES | 5               | 1               | 1                     | 2            | 1        | 1               |
| 93-AFB-090 | 466850             | 5158900             | YES              | YES                  | YES               | YES | 5               | 1               | 1                     | 2            | 1        | 1               |
| 93-AFB-091 | 467700             | 5159550             | YES              | YES                  | YES               | YES | 5               | 1               | 1                     | 3            | 1        | 4               |
| 93-AFB-092 | 467200             | 5158600             | YES              | YES                  | YES               | YES | 5               | 1               | 2                     | 3            | 1        | 1               |
| 93-AFB-093 | 468600             | 5157950             | YES              | YES                  | YES               | YES | 4               | 1               | 2                     | 3            | 1        | 2               |
| 93-AFB-094 | 474950             | 5170650             | YES              | YES                  | YES               | YES | 8               | 1               | 1                     | 3            | 1        | 2               |
| 93-AFB-095 | 474650             | 5170750             | YES              | YES                  | YES               | YES | 8               | 1               | 1                     | 1            | 1        | 1               |
| 93-AFB-096 | 474650             | 5170950             | YES              | YES                  | YES               | YES | 8               | 2               | 1                     | 2            | 1        | 2               |
| 93-AFB-097 | 474500             | 5171150             | YES              | YES                  | YES               | YES | 8               | 1               | 1                     | 1            | 1        | 2               |
| 93-AFB-098 | 467900             | 5159050             | YES              | YES                  | YES               | YES | 5               | 1               | 1                     | 3            | 1        | 1               |
| 93-AFB-099 | 467250             | 5160550             | YES              | YES                  | YES               | YES | 5               | 1               | 2                     | 3            | 1        | 2               |
| 93-AFB-100 | 474900             | 5162950             | YES              | YES                  | YES               | YES | 3               | 1               | 1                     | 3            | 1        | 1               |
| 93-AFB-101 | 475500             | 5162850             | YES              | YES                  | YES               | YES | 3               | 1               | 1                     | 2            | 1        | 2               |
| 93-AFB-102 | 477850             | 5169500             | YES              | YES                  | YES               | YES | 5               | 1               | 1                     | 3            | 1        | 2               |
| 93-AFB-103 | 482900             | 5171250             | YES              | YES                  | YES               | YES | 5               | 1               | 1                     | 3            | 1        | 3               |
| 93-AFB-104 | 490300             | 5180200             | YES              | YES                  | YES               | YES | 8               | 1               | 1                     | 3            | 1        | 2               |
| 93-AFB-105 | 489500             | 5180850             | YES              | YES                  | YES               | YES | 8               | 2               | 1                     | 1            | 1        | 2               |
| 93-AFB-106 | 489050             | 5181400             | YES              | YES                  | YES               | YES | 8               | 1               | 1                     | 3            | 2        | 1               |
| 93-AFB-107 | 492200             | 5181400             | YES              | YES                  | YES               | YES | 8               | 1               | 1                     | 4            | 1        | 1               |
| 93-AFB-108 | 509400             | 5178600             | YES              | YES                  | YES               | YES | 7               | 1               | 1                     | 3            | 1        | 3               |
| 93-AFB-109 | 509200             | 5177950             | YES              | YES                  | YES               | YES | 5               | 1               | 1                     | 1            | 1        | 1               |
| 93-AFB-110 | 509100             | 5176800             | YES              | YES                  | YES               | YES | 5               | 3               | 1                     | 3            | 1        | 1               |
| 93-AFB-111 | 509900             | 5177750             | YES              | YES                  | YES               | YES | 8               | 1               | 1                     | 3            | 1        | 1               |
| 93-AFB-112 | 509050             | 5179650             | NO               | YES                  | YES               | YES | 8               | 1               | 1                     | 4            | 1        | 2               |
| 93-AFB-113 | 509500             | 5179500             | YES              | YES                  | YES               | YES | 7               | 2               | 1                     | 3            | 1        | 3               |
| 93-AFB-114 | 509450             | 5179650             | NO               | YES                  | YES               | YES | 8               | 1               | 1                     | 4            | 1        | 3               |
| 93-AFB-115 | 509400             | 5179850             | YES              | YES                  | YES               | YES | 8               | 2               | 1                     | 2            | 1        | 1               |
| 93-AFB-116 | 509200             | 5179850             | NO               | NO                   | YES               | YES | 12              | 1               | na                    | 4            | 1        | 3               |
| 93-AFB-117 | 509450             | 5179250             | YES              | YES                  | NO                | NO  | 7               | 1               | 1                     | 3            | 1        | 2               |
| 93-AFB-118 | 508950             | 5179450             | YES              | YES                  | YES               | YES | 7               | 2               | 1                     | 3            | 1        | 2               |
| 93-AFB-119 | 516820             | 5170080             | NO               | NO                   | YES               | NO  | 10              | 1               | 2                     | 2            | 1        | 1               |
| 93-AFB-120 | 516450             | 5172300             | NO               | NO                   | YES               | NO  | 10              | 1               | na                    | 2            | 1        | 1               |
| 93-AFB-121 | 517000             | 5170450             | YES              | YES                  | YES               | YES | 11              | 1               | 1                     | 3            | 1        | 1               |
| 93-AFB-122 | 514450             | 5167950             | YES              | YES                  | YES               | YES | 6               | 1               | 1                     | 3            | 1        | 5               |
| 93-AFB-123 | 513950             | 5168000             | YES              | YES                  | YES               | YES | 5               | 1               | 1                     | 2            | 2        | 2               |
| 93-AFB-124 | 514050             | 5168150             | YES              | YES                  | YES               | YES | 6               | 1               | 1                     | 2            | 1        | 1               |
| 93-AFB-125 | 514050             | 5169000             | YES              | YES                  | YES               | YES | 7               | 1               | 1                     | 2            | 1        | 2               |
| 93-AFB-126 | 514200             | 5169150             | YES              | YES                  | YES               | YES | 7               | 2               | 1                     | 2            | 1        | 1               |
| 93-AFB-127 | 513950             | 5169250             | YES              | YES                  | YES               | YES | 7               | 1               | 2                     | 3            | 1        | 1               |
| 93-AFB-128 | 514150             | 5168500             | YES              | YES                  | YES               | YES | 6               | 2               | 1                     | 2            | 1        | 2               |
| 93-AFB-129 | 514300             | 5169150             | YES              | YES                  | YES               | YES | 7               | 2               | 1                     | 3            | 1        | 1               |
| 93-AFB-130 | 514300             | 5169350             | YES              | YES                  | YES               | YES | 7               | 2               | 1                     | 2            | 1        | 2               |
| 93-AFB-131 | 514250             | 5169500             | YES              | YES                  | YES               | NO  | 7               | 1               | 1                     | 3            | 1        | 3               |
| 93-AFB-132 | 465250             | 5145450             | NO               | NO                   | YES               | NO  | 5               | 1               | 1                     | 2            | 1        | 2               |
| 93-AFB-133 | 459500             | 5150050             | YES              | YES                  | YES               | YES | 6               | 1               | 2                     | 2            | 1        | 3               |
| 93-AFB-134 | 508500             | 5185150             | NO               | NO                   | YES               | NO  | 12              | 1               | 1                     | 4            | 1        | 1               |
| 93-AFB-135 | 509600             | 5186200             | NO               | NO                   | YES               | NO  | 10              | 1               | 2                     | 3            | 1        | 1               |
| 93-AFB-136 | 512050             | 5167450             | NO               | NO                   | YES               | NO  | 5               | 2               | 1                     | 2            | 1        | 3               |
| 93-AFB-137 | 510010             | 5184240             | NO               | NO                   | YES               | NO  | 12              | 2               | 1                     | 3            | 1        | 1               |
| 93-AFB-138 | 509100             | 5182900             | NO               | NO                   | YES               | NO  | 12              | 1               | 1                     | 3            | 1        | 1               |
| 93-AFB-139 | 509100             | 5182900             | NO               | NO                   | YES               | NO  | 12              | 1               | 1                     | 3            | 1        | 1               |
| 93-AFB-140 | 509100             | 5182900             | NO               | NO                   | YES               | NO  | 12              | 1               | 1                     | 3            | 1        | 1               |
| 93-AFB-141 | 509100             | 5182900             | NO               | NO                   | YES               | NO  | 12              | 1               | 1                     | 3            | 1        | 1               |
| 93-AFB-142 | 509100             | 5182900             | NO               | NO                   | YES               | NO  | 12              | 1               | 1                     | 3            | 1        | 1               |
| 93-AFB-143 | 509100             | 5182900             | NO               | NO                   | YES               | NO  | 12              | 1               | 1                     | 3            | 1        | 1               |
| 93-AFB-144 | 509100             | 5182900             | NO               | NO                   | YES               | NO  | 12              | 1               | 1                     | 3            | 1        | 1               |
| 93-AFB-145 | 509100             | 5182900             | NO               | NO                   | YES               | NO  | 12              | 1               | 1                     | 3            | 1        | 1               |
| 93-AFB-146 | 509800             | 5180200             | YES              | YES                  | YES               | YES | 8               | 1               | 1                     | 3            | 1        | 1               |
| 93-AFB-147 | 509750             | 5179950             | YES              | YES                  | YES               | YES | 12              | 1               | 1                     | 3            | 1        | 2               |
| 93-AFB-148 | 474550             | 5169980             | NO               | NO                   | YES               | NO  | 8               | 1               | na                    | 3            | 1        | 1               |
| 93-AFB-149 | 474550             | 5169600             | YES              | YES                  | YES               | YES | 7               | 2               | 1                     | 2            | 1        | 1               |
| 93-AFB-150 | 474600             | 5169750             | NO               | YES                  | YES               | YES | 8               | 1               | 1                     | 4            | 1        | 1               |

| SAMPLE ID  | Easting<br>(NAD27) | Northing<br>(NAD27) | Humus<br>Sampled | B-Horizon<br>Sampled | C-Horizon Sampled |     | Bedrock<br>Type | Moraine<br>Type | B-Horizon<br>Material | Tree<br>Type | Drainage | Topo<br>Setting |
|------------|--------------------|---------------------|------------------|----------------------|-------------------|-----|-----------------|-----------------|-----------------------|--------------|----------|-----------------|
|            |                    |                     |                  |                      | -63 µm            | HMC |                 |                 |                       |              |          |                 |
| 93-AFB-151 | 474700             | 5170210             | NO               | NO                   | YES               | NO  | 8               | 1               | 1                     | 2            | 1        | 2               |
| 93-AFB-152 | 473900             | 5169300             | NO               | YES                  | YES               | YES | 8               | 2               | 1                     | 3            | 1        | 2               |
| 93-AFB-153 | 474350             | 5169650             | YES              | YES                  | NO                | NO  | 8               | 1               | 1                     | 1            | 1        | 3               |
| 93-AFB-154 | 474000             | 5169650             | YES              | YES                  | YES               | YES | 8               | 1               | 1                     | 2            | 1        | 1               |
| 93-AFB-155 | 473850             | 5169500             | YES              | YES                  | YES               | YES | 8               | 1               | 1                     | 2            | 1        | 1               |
| 93-AFB-156 | 473600             | 5169350             | YES              | YES                  | YES               | YES | 8               | 1               | 1                     | 3            | 1        | 2               |
| 93-AFB-157 | 473750             | 5169250             | YES              | YES                  | YES               | YES | 8               | 2               | 1                     | 3            | 1        | 2               |
| 93-AFB-158 | 474700             | 5169300             | YES              | YES                  | YES               | YES | 7               | 1               | 1                     | 2            | 1        | 1               |
| 93-AFB-159 | 509150             | 5183050             | NO               | NO                   | YES               | NO  | 9               | 1               | 1                     | 1            | 2        | 1               |
| 93-AFB-160 | 509150             | 5183050             | NO               | NO                   | YES               | NO  | 9               | 1               | 1                     | 1            | 2        | 1               |
| 93-AFB-161 | 509150             | 5183050             | NO               | NO                   | YES               | NO  | 9               | 1               | 1                     | 1            | 2        | 1               |
| 93-AFB-162 | 509150             | 5183050             | NO               | NO                   | YES               | NO  | 9               | 1               | 1                     | 1            | 2        | 1               |
| 93-AFB-163 | 509150             | 5183050             | NO               | NO                   | YES               | NO  | 9               | 1               | 1                     | 1            | 2        | 2               |
| 93-AFB-164 | 509150             | 5183050             | NO               | NO                   | YES               | NO  | 9               | 1               | 1                     | 1            | 2        | 2               |
| 93-AFB-165 | 509150             | 5183050             | NO               | NO                   | YES               | NO  | 9               | 1               | 1                     | 1            | 2        | 2               |
| 93-AFB-166 | 509150             | 5183050             | NO               | NO                   | YES               | NO  | 9               | 1               | 1                     | 1            | 2        | 2               |
| 93-AFB-167 | 509150             | 5183050             | NO               | NO                   | YES               | NO  | 9               | 1               | 1                     | 1            | 2        | 2               |
| 93-AFB-168 | 509150             | 5183050             | NO               | NO                   | YES               | NO  | 9               | 1               | 1                     | 1            | 2        | 2               |
| 93-AFB-169 | 470350             | 5161950             | YES              | YES                  | YES               | YES | 5               | 2               | 1                     | 2            | 1        | 4               |
| 93-AFB-170 | 470150             | 5162700             | YES              | YES                  | YES               | YES | 5               | 1               | 2                     | 2            | 1        | 1               |
| 93-AFB-171 | 458800             | 5154750             | YES              | YES                  | YES               | YES | 8               | 2               | 1                     | 3            | 1        | 1               |
| 93-AFB-172 | 512300             | 5170550             | YES              | YES                  | YES               | YES | 7               | 2               | 1                     | 1            | 1        | 2               |
| 93-AFB-173 | 513700             | 5167500             | NO               | YES                  | YES               | YES | 5               | 2               | 1                     | 4            | 1        | 2               |
| 93-AFB-174 | 514050             | 5167650             | YES              | YES                  | YES               | YES | 5               | 1               | 1                     | 3            | 1        | 2               |
| 93-AFB-175 | 514800             | 5171450             | YES              | YES                  | YES               | YES | 8               | 2               | 2                     | 3            | 1        | 2               |
| 93-AFB-176 | 514800             | 5172950             | YES              | YES                  | YES               | YES | 8               | 1               | 1                     | 3            | 1        | 2               |
| 93-AFB-177 | 512500             | 5174150             | YES              | YES                  | YES               | NO  | 8               | 2               | 1                     | 3            | 1        | 1               |
| 93-AFB-178 | 509950             | 5176200             | YES              | YES                  | YES               | YES | 8               | 2               | 1                     | 2            | 1        | 2               |
| 93-AFB-179 | 511150             | 5178250             | YES              | YES                  | YES               | YES | 8               | 2               | 1                     | 2            | 1        | 2               |
| 93-AFB-180 | 513500             | 5181650             | YES              | YES                  | YES               | YES | 10              | 1               | 1                     | 3            | 1        | 1               |
| 93-AFB-181 | 501550             | 5179450             | YES              | YES                  | YES               | YES | 8               | 2               | 1                     | 3            | 1        | 3               |
| 93-AFB-182 | 500100             | 5181100             | YES              | YES                  | YES               | YES | 8               | 1               | 1                     | 3            | 1        | 1               |
| 93-AFB-183 | 498600             | 5180350             | YES              | YES                  | YES               | NO  | 8               | 3               | 1                     | 1            | 1        | 1               |
| 93-AFB-184 | 497650             | 5182200             | YES              | YES                  | YES               | YES | 8               | 3               | 1                     | 3            | 1        | 2               |
| 93-AFB-185 | 495200             | 5180200             | YES              | YES                  | YES               | NO  | 8               | 2               | 1                     | 1            | 1        | 2               |
| 93-AFB-186 | 500750             | 5176250             | YES              | YES                  | YES               | YES | 5               | 1               | 1                     | 1            | 1        | 2               |
| 93-AFB-187 | 499300             | 5177150             | YES              | YES                  | YES               | YES | 12              | 3               | 1                     | 1            | 1        | 1               |
| 93-AFB-188 | 496750             | 5177300             | YES              | YES                  | NO                | NO  | 12              | 3               | 2                     | 3            | 2        | 4               |
| 93-AFB-189 | 493300             | 5176550             | YES              | YES                  | YES               | YES | 7               | 1               | 2                     | 1            | 1        | 2               |
| 93-AFB-190 | 491600             | 5176200             | YES              | YES                  | YES               | YES | 7               | 3               | 1                     | 1            | 1        | 2               |
| 93-AFB-191 | 488950             | 5174900             | YES              | YES                  | YES               | YES | 8               | 3               | 1                     | 1            | 1        | 2               |
| 93-AFB-192 | 488300             | 5176750             | YES              | YES                  | YES               | YES | 8               | 1               | 1                     | 1            | 1        | 1               |
| 93-AFB-193 | 487150             | 5179900             | YES              | YES                  | YES               | YES | 8               | 2               | 1                     | 3            | 1        | 2               |
| 93-AFB-194 | 483500             | 5179950             | YES              | YES                  | YES               | YES | 8               | 2               | 1                     | 1            | 1        | 2               |
| 93-AFB-195 | 482650             | 5181550             | YES              | YES                  | YES               | YES | 8               | 1               | 1                     | 1            | 1        | 1               |
| 93-AFB-196 | 481350             | 5180250             | YES              | YES                  | YES               | YES | 8               | 1               | 1                     | 3            | 1        | 4               |
| 93-AFB-197 | 477400             | 5180950             | YES              | YES                  | YES               | YES | 8               | 1               | 1                     | 1            | 1        | 1               |
| 93-AFB-198 | 478450             | 5178300             | YES              | YES                  | YES               | YES | 8               | 1               | 1                     | 1            | 1        | 1               |
| 93-AFB-199 | 476550             | 5174650             | YES              | YES                  | YES               | YES | 8               | 1               | 1                     | 1            | 1        | 1               |
| 93-AFB-200 | 479900             | 5174450             | YES              | YES                  | YES               | YES | 8               | 1               | 1                     | 3            | 1        | 1               |
| 93-AFB-201 | 485050             | 5174600             | YES              | YES                  | YES               | YES | 8               | 2               | 1                     | 3            | 1        | 4               |
| 93-AFB-202 | 483750             | 5173400             | YES              | YES                  | YES               | YES | 8               | 2               | 1                     | 3            | 1        | 1               |
| 93-AFB-203 | 482200             | 5172250             | YES              | YES                  | YES               | YES | 8               | 1               | 1                     | 1            | 1        | 1               |
| 93-AFB-204 | 484100             | 5169900             | YES              | YES                  | YES               | NO  | 4               | 2               | 1                     | 2            | 1        | 1               |
| 93-AFB-205 | 488600             | 5170050             | YES              | YES                  | YES               | YES | 3               | 3               | 1                     | 3            | 1        | 3               |
| 93-AFB-206 | 487550             | 5171600             | YES              | YES                  | YES               | YES | 4               | 2               | 2                     | 3            | 1        | 2               |
| 93-AFB-207 | 472500             | 5162250             | YES              | YES                  | YES               | YES | 5               | 1               | 1                     | 1            | 1        | 2               |
| 93-AFB-208 | 475950             | 5164600             | YES              | YES                  | YES               | YES | 4               | 3               | 1                     | 3            | 1        | 2               |
| 93-AFB-209 | 477900             | 5165750             | YES              | YES                  | YES               | YES | 3               | 1               | 1                     | 3            | 1        | 2               |
| 93-AFB-210 | 477100             | 5166950             | YES              | YES                  | YES               | YES | 5               | 2               | 1                     | 3            | 1        | 2               |
| 93-AFB-211 | 478800             | 5167950             | YES              | YES                  | YES               | YES | 5               | 2               | 2                     | 2            | 1        | 1               |
| 93-AFB-212 | 476300             | 5168150             | YES              | YES                  | YES               | YES | 5               | 1               | 1                     | 3            | 1        | 2               |
| 93-AFB-213 | 476250             | 5170000             | YES              | YES                  | YES               | YES | 7               | 1               | 1                     | 3            | 1        | 2               |
| 93-AFB-214 | 477550             | 5171050             | YES              | YES                  | YES               | YES | 8               | 1               | 2                     | 3            | 1        | 2               |

| SAMPLE ID  | Easting<br>(NAD27) | Northing<br>(NAD27) | Humus<br>Sampled | B-Horizon<br>Sampled | C-Horizon Sampled |     | Bedrock<br>Type | Moraine<br>Type | B-Horizon<br>Material | Tree<br>Type | Drainage | Topo<br>Setting |
|------------|--------------------|---------------------|------------------|----------------------|-------------------|-----|-----------------|-----------------|-----------------------|--------------|----------|-----------------|
|            |                    |                     |                  |                      | -63 $\mu$ m       | HMC |                 |                 |                       |              |          |                 |
| 93-AFB-215 | 474100             | 5172250             | YES              | YES                  | YES               | YES | 8               | 2               | 1                     | 1            | 1        | 3               |
| 93-AFB-216 | 502200             | 5174450             | YES              | YES                  | YES               | YES | 4               | 1               | 1                     | 2            | 1        | 1               |
| 93-AFB-217 | 502200             | 5175600             | YES              | YES                  | YES               | YES | 5               | 1               | 2                     | 3            | 1        | 2               |
| 93-AFB-218 | 502000             | 5177100             | YES              | YES                  | YES               | YES | 6               | 1               | 1                     | 3            | 1        | 1               |
| 93-AFB-219 | 495800             | 5177150             | YES              | YES                  | YES               | YES | 5               | 1               | 1                     | 2            | 1        | 1               |
| 93-AFB-220 | 465700             | 5156200             | YES              | YES                  | YES               | YES | 5               | 1               | 2                     | 1            | 1        | 2               |
| 93-AFB-221 | 467350             | 5157450             | YES              | YES                  | YES               | YES | 4               | 1               | 1                     | 3            | 1        | 1               |
| 93-AFB-222 | 466400             | 5169900             | YES              | YES                  | YES               | YES | 8               | 2               | 1                     | 3            | 1        | 2               |
| 93-AFB-223 | 467100             | 5165850             | YES              | YES                  | YES               | YES | 8               | 1               | 1                     | 3            | 1        | 1               |
| 93-AFB-224 | 462700             | 5163450             | YES              | YES                  | NO                | NO  | 8               | 1               | 1                     | 1            | 1        | 1               |
| 93-AFB-225 | 457100             | 5160500             | YES              | YES                  | YES               | YES | 8               | 3               | 2                     | 1            | 1        | 2               |
| 93-AFB-226 | 460200             | 5159500             | YES              | YES                  | YES               | YES | 8               | 2               | 1                     | 3            | 1        | 2               |
| 93-AFB-227 | 462100             | 5155450             | YES              | YES                  | YES               | YES | 5               | 1               | 2                     | 1            | 1        | 1               |
| 93-AFB-228 | 464150             | 5153650             | YES              | YES                  | YES               | YES | 4               | 2               | 1                     | 2            | 1        | 2               |
| 93-AFB-229 | 461800             | 5151750             | YES              | YES                  | YES               | YES | 5               | 2               | 1                     | 2            | 1        | 1               |
| 93-AFB-230 | 463500             | 5147950             | YES              | NO                   | NO                | NO  | 5               | na              | 2                     | 2            | 1        | 2               |

**Appendix B. Heavy mineral weight data.**

| SAMPLE<br>NO. | WEIGHT (KG WET) |              |               | WEIGHT (GMS DRY) |                  |                |            |      | GOLD        |             |
|---------------|-----------------|--------------|---------------|------------------|------------------|----------------|------------|------|-------------|-------------|
|               | TABLE<br>SPLIT  | +10<br>CHIPS | TABLE<br>FEED | TABLE<br>CONC    | M.I. CONCENTRATE |                |            |      | NO.<br>V.G. | CALC<br>PPB |
|               |                 |              |               |                  | M.I.<br>LIGHTS   | CONC.<br>TOTAL | NON<br>MAG | MAG  |             |             |
| 92-AFB- 4001  | 6.7             | 1.9          | 4.9           | 257.6            | 235.7            | 21.9           | 15.2       | 6.7  | 6           | 499         |
| 92-AFB- 4002  | 7.0             | 2.7          | 4.3           | 253.3            | 207.6            | 45.7           | 29.2       | 16.5 | 5           | 109         |
| 92-AFB- 4003  | 7.5             | 3.0          | 4.5           | 129.3            | 110.0            | 19.3           | 12.5       | 6.8  | 3           | 85          |
| 92-AFB- 4006  | 7.4             | 1.2          | 6.2           | 226.4            | 192.1            | 34.3           | 22.8       | 11.5 | 3           | 532         |
| 92-AFB- 4007  | 7.2             | 2.0          | 5.2           | 166.5            | 145.3            | 21.2           | 12.7       | 8.5  | 5           | 53          |
| 92-AFB- 4009  | 7.7             | 2.1          | 5.6           | 238.8            | 216.8            | 22.0           | 12.4       | 9.6  | 9           | 192         |
| 92-AFB- 4011  | 6.2             | 0.5          | 5.8           | 153.5            | 131.0            | 22.5           | 15.3       | 7.2  | 7           | 314         |
| 92-AFB- 4012  | 8.4             | 1.6          | 6.9           | 266.8            | 235.1            | 31.7           | 20.7       | 11.0 | 12          | 1873        |
| 92-AFB- 4014  | 6.3             | 1.3          | 5.0           | 184.8            | 157.9            | 26.9           | 16.8       | 10.1 | 2           | 354         |
| 92-AFB- 4015  | 6.6             | 0.7          | 5.9           | 194.3            | 169.1            | 25.2           | 16.9       | 8.3  | 5           | 269         |
| 92-AFB- 4016  | 6.9             | 1.1          | 5.9           | 171.0            | 147.1            | 23.9           | 17.2       | 6.7  | 1           | 1           |
| 92-AFB- 4017  | 6.4             | 0.5          | 5.9           | 210.3            | 180.2            | 30.1           | 20.1       | 10.0 | 3           | 776         |
| 92-AFB- 4019  | 6.9             | 0.5          | 6.4           | 149.8            | 130.8            | 19.0           | 13.6       | 5.4  | 1           | 74          |
| 92-AFB- 4020  | 6.2             | 0.4          | 5.8           | 116.8            | 100.0            | 16.8           | 11.6       | 5.2  | 2           | 14          |
| 92-AFB- 4021  | 7.4             | 0.7          | 6.7           | 177.6            | 169.1            | 8.5            | 5.6        | 2.9  | 1           | 34          |
| 92-AFB- 4022  | 6.4             | 0.3          | 6.1           | 217.3            | 206.5            | 10.8           | 7.4        | 3.4  | 1           | 26          |
| 92-AFB- 4023  | 8.2             | 1.2          | 7.0           | 176.2            | 153.4            | 22.8           | 16.0       | 6.8  | 1           | 23          |
| 92-AFB- 4024  | 7.8             | 1.5          | 6.4           | 204.0            | 188.4            | 15.6           | 11.2       | 4.4  | 2           | 124         |
| 92-AFB- 4025  | 8.3             | 1.4          | 6.9           | 137.4            | 119.8            | 17.6           | 11.0       | 6.6  | 3           | 659         |
| 92-AFB- 4027  | 7.3             | 2.1          | 5.3           | 185.2            | 156.7            | 28.5           | 22.0       | 6.5  | 1           | 29          |
| 92-AFB- 4028  | 7.6             | 1.3          | 6.4           | 234.8            | 226.0            | 8.8            | 5.3        | 3.5  | 4           | 5749        |
| 92-AFB- 4029  | 8.0             | 1.3          | 6.7           | 214.9            | 193.9            | 21.0           | 14.0       | 7.0  | 2           | 15          |
| 92-AFB- 4031  | 6.6             | 1.0          | 5.6           | 205.5            | 189.6            | 15.9           | 10.3       | 5.6  | 23          | 246         |
| 92-AFB- 4032  | 8.5             | 0.7          | 7.8           | 269.7            | 227.4            | 42.3           | 26.7       | 15.6 | 6           | 24          |
| 92-AFB- 4033  | 8.0             | 1.6          | 6.5           | 278.4            | 234.2            | 44.2           | 25.4       | 18.8 | 0           | 0           |
| 92-AFB- 4034  | 7.9             | 1.5          | 6.4           | 281.4            | 235.9            | 45.5           | 27.2       | 18.3 | 1           | 1           |
| 92-AFB- 4036  | 8.0             | 2.0          | 6.1           | 236.3            | 186.3            | 50.0           | 24.9       | 25.1 | 0           | 0           |
| 92-AFB- 4037  | 7.9             | 1.1          | 6.8           | 321.2            | 267.5            | 53.7           | 35.1       | 18.6 | 3           | 17          |
| 92-AFB- 4038  | 8.5             | 2.1          | 6.5           | 244.1            | 201.2            | 42.9           | 25.1       | 17.8 | 3           | 316         |
| 92-AFB- 4039  | 8.4             | 1.5          | 7.0           | 267.6            | 226.2            | 41.4           | 23.3       | 18.1 | 1           | 8           |
| 92-AFB- 4040  | 8.7             | 2.9          | 5.8           | 202.9            | 151.8            | 51.1           | 29.9       | 21.2 | 1           | 1           |
| 92-AFB- 4041  | 8.3             | 1.7          | 6.7           | 199.1            | 148.0            | 51.1           | 28.5       | 22.6 | 2           | 20          |
| 92-AFB- 4043  | 8.0             | 1.3          | 6.7           | 234.6            | 196.5            | 38.1           | 19.2       | 18.9 | 0           | 0           |
| 92-AFB- 4044  | 8.4             | 1.5          | 7.0           | 185.7            | 161.6            | 24.1           | 13.9       | 10.2 | 0           | 0           |
| 92-AFB- 4047  | 7.4             | 1.9          | 5.5           | 172.1            | 137.6            | 34.5           | 17.9       | 16.6 | 0           | 0           |
| 92-AFB- 4048  | 8.9             | 1.1          | 7.8           | 187.8            | 140.9            | 46.9           | 29.2       | 17.7 | 1           | 169         |
| 92-AFB- 4049  | 8.5             | 1.0          | 7.5           | 257.9            | 174.0            | 83.9           | 68.3       | 15.6 | 1           | 5           |
| 92-AFB- 4050  | 8.5             | 0.9          | 7.6           | 228.6            | 164.3            | 64.3           | 51.1       | 13.2 | 0           | 0           |
| 92-AFB- 4051  | 7.9             | 1.8          | 6.1           | 245.4            | 171.8            | 73.6           | 50.8       | 22.8 | 3           | 86          |
| 92-AFB- 4052  | 8.3             | 1.6          | 6.8           | 191.5            | 144.8            | 46.7           | 29.4       | 17.3 | 0           | 0           |
| 92-AFB- 4055  | 8.2             | 1.2          | 7.0           | 172.8            | 141.2            | 31.6           | 17.8       | 13.8 | 0           | 0           |
| 92-AFB- 4056  | 7.6             | 1.3          | 6.3           | 142.1            | 99.8             | 42.3           | 19.7       | 22.6 | 3           | 61          |
| 92-AFB- 4058  | 8.2             | 0.7          | 7.5           | 155.9            | 125.4            | 30.5           | 16.2       | 14.3 | 1           | 93          |
| 92-AFB- 4059  | 8.7             | 1.9          | 6.8           | 165.7            | 137.9            | 27.8           | 15.7       | 12.1 | 2           | 29          |
| 92-AFB- 4060  | 8.7             | 1.0          | 7.7           | 169.4            | 131.2            | 38.2           | 24.5       | 13.7 | 24          | 247         |
| 92-AFB- 4061  | 8.9             | 1.2          | 7.8           | 325.6            | 290.3            | 35.3           | 23.8       | 11.5 | 9           | 50          |
| 92-AFB- 4062  | 8.4             | 0.8          | 7.6           | 232.0            | 157.0            | 75.0           | 57.5       | 17.5 | 19          | 63          |
| 92-AFB- 4063  | 7.7             | 1.3          | 6.4           | 261.9            | 229.4            | 32.5           | 21.1       | 11.4 | 16          | 195         |
| 92-AFB- 4064  | 8.3             | 0.8          | 7.5           | 324.7            | 260.5            | 64.2           | 42.1       | 22.1 | 6           | 11          |
| 92-AFB- 4065  | 7.8             | 0.9          | 7.0           | 304.4            | 234.5            | 69.9           | 42.2       | 27.7 | 2           | 20          |
| 92-AFB- 4066  | 7.0             | 0.8          | 6.2           | 259.5            | 235.3            | 24.2           | 15.2       | 9.0  | 7           | 314         |
| 92-AFB- 4067  | 7.7             | 0.9          | 6.8           | 174.4            | 145.5            | 28.9           | 17.0       | 11.9 | 1           | 5           |
| 92-AFB- 4068  | 8.8             | 1.6          | 7.2           | 369.9            | 319.2            | 50.7           | 33.1       | 17.6 | 1           | 87          |
| 92-AFB- 4069  | 8.6             | 1.2          | 7.4           | 319.4            | 254.3            | 65.1           | 28.1       | 37.0 | 2           | 10          |
| 92-AFB- 4071  | 6.8             | 0.7          | 6.1           | 162.4            | 142.2            | 20.2           | 12.6       | 7.6  | 6           | 224         |
| 92-AFB- 4072  | 8.2             | 1.4          | 6.8           | 201.9            | 165.3            | 36.6           | 23.6       | 13.0 | 3           | 15          |
| 92-AFB- 4073  | 7.9             | 1.5          | 6.4           | 170.4            | 151.0            | 19.4           | 11.2       | 8.2  | 1           | 57          |
| 92-AFB- 4074  | 8.2             | 1.8          | 6.5           | 210.7            | 185.6            | 25.1           | 14.6       | 10.5 | 2           | 82          |
| 92-AFB- 4075  | 8.2             | 1.4          | 6.8           | 252.3            | 223.7            | 28.6           | 14.8       | 13.8 | 3           | 365         |
| 92-AFB- 4076  | 8.5             | 1.7          | 6.8           | 193.4            | 172.2            | 21.2           | 11.8       | 9.4  | 3           | 389         |
| 92-AFB- 4077  | 8.2             | 1.9          | 6.4           | 194.0            | 176.2            | 17.8           | 9.0        | 8.8  | 2           | 1946        |



| SAMPLE<br>NO. | WEIGHT (KG WET) |              |               | WEIGHT (GMS DRY) |                  |                |            |      | GOLD        |             |
|---------------|-----------------|--------------|---------------|------------------|------------------|----------------|------------|------|-------------|-------------|
|               | TABLE<br>SPLIT  | +10<br>CHIPS | TABLE<br>FEED | TABLE<br>CONC    | M.I. CONCENTRATE |                |            |      | NO.<br>V.G. | CALC<br>PPB |
|               |                 |              |               |                  | M.I.<br>LIGHTS   | CONC.<br>TOTAL | NON<br>MAG | MAG  |             |             |
| 92-AFB- 4078  | 8.3             | 1.7          | 6.6           | 202.7            | 173.0            | 29.7           | 15.3       | 14.4 | 1           | 42          |
| 92-AFB- 4079  | 8.2             | 1.4          | 6.8           | 229.2            | 196.1            | 33.1           | 20.5       | 12.6 | 1           | 31          |
| 92-AFB- 4080  | 8.3             | 2.3          | 6.0           | 177.8            | 144.2            | 33.6           | 20.8       | 12.8 | 2           | 49          |
| 92-AFB- 4081  | 8.8             | 1.4          | 7.4           | 198.7            | 166.0            | 32.7           | 16.3       | 16.4 | 2           | 1006        |
| 92-AFB- 4082  | 8.1             | 2.2          | 5.9           | 185.4            | 139.4            | 46.0           | 18.4       | 27.6 | 0           | 0           |
| 92-AFB- 4083  | 7.0             | 0.7          | 6.4           | 130.0            | 120.8            | 9.2            | 3.9        | 5.3  | 0           | 0           |
| 92-AFB- 4084  | 8.7             | 1.3          | 7.4           | 150.0            | 121.5            | 28.5           | 15.8       | 12.7 | 1           | 41          |
| 92-AFB- 4085  | 8.8             | 1.7          | 7.1           | 192.4            | 138.8            | 53.6           | 25.2       | 28.4 | 0           | 0           |
| 92-AFB- 4086  | 8.8             | 1.8          | 7.0           | 208.1            | 169.5            | 38.6           | 21.0       | 17.6 | 1           | 18          |
| 92-AFB- 4087  | 8.3             | 1.4          | 6.9           | 241.2            | 165.7            | 75.5           | 40.0       | 35.5 | 0           | 0           |
| 92-AFB- 4088  | 7.8             | 1.2          | 6.6           | 255.7            | 198.7            | 57.0           | 45.0       | 12.0 | 0           | 0           |
| 92-AFB- 4089  | 8.6             | 1.9          | 6.7           | 156.2            | 116.3            | 39.9           | 15.6       | 24.3 | 1           | 5           |
| 92-AFB- 4090  | 9.3             | 1.0          | 8.3           | 162.1            | 132.7            | 29.4           | 20.6       | 8.8  | 1           | 9           |
| 92-AFB- 4091  | 9.1             | 1.6          | 7.5           | 167.1            | 132.4            | 34.7           | 23.7       | 11.0 | 3           | 70          |
| 92-AFB- 4092  | 9.7             | 2.0          | 7.7           | 183.9            | 150.2            | 33.7           | 20.6       | 13.1 | 0           | 0           |
| 92-AFB- 4093  | 9.3             | 1.0          | 8.3           | 137.5            | 113.6            | 23.9           | 15.5       | 8.4  | 3           | 511         |
| 92-AFB- 4094  | 8.8             | 1.5          | 7.3           | 119.6            | 101.3            | 18.3           | 11.7       | 6.6  | 0           | 0           |
| 92-AFB- 4095  | 7.7             | 0.5          | 7.2           | 144.6            | 134.8            | 9.8            | 6.1        | 3.7  | 0           | 0           |
| 92-AFB- 4096  | 8.1             | 1.7          | 6.5           | 146.0            | 114.9            | 31.1           | 19.8       | 11.3 | 0           | 0           |
| 92-AFB- 4097  | 8.4             | 2.0          | 6.5           | 157.7            | 128.6            | 29.1           | 15.3       | 13.8 | 0           | 0           |
| 92-AFB- 4098  | 8.9             | 1.8          | 7.1           | 208.5            | 166.7            | 41.8           | 28.1       | 13.7 | 7           | 137         |
| 92-AFB- 4099  | 8.8             | 1.7          | 7.1           | 198.0            | 154.0            | 44.0           | 27.7       | 16.3 | 3           | 114         |
| 92-AFB- 4100  | 9.3             | 0.9          | 8.4           | 239.7            | 230.1            | 9.6            | 5.8        | 3.8  | 5           | 475         |
| 92-AFB- 4101  | 9.4             | 1.8          | 7.6           | 238.7            | 215.3            | 23.4           | 14.8       | 8.6  | 2           | 18          |
| 92-AFB- 4102  | 8.3             | 1.1          | 7.2           | 191.1            | 179.6            | 11.5           | 6.9        | 4.6  | 1           | 54          |
| 92-AFB- 4103  | 9.6             | 1.6          | 8.0           | 111.3            | 93.3             | 18.0           | 11.4       | 6.6  | 8           | 526         |
| 92-AFB- 4104  | 9.7             | 1.4          | 8.4           | 271.1            | 194.8            | 76.3           | 52.8       | 23.5 | 5           | 273         |
| 92-AFB- 4105  | 8.2             | 0.2          | 8.0           | 241.9            | 212.5            | 29.4           | 20.3       | 9.1  | 6           | 53          |
| 92-AFB- 4106  | 9.0             | 1.4          | 7.6           | 372.4            | 320.6            | 51.8           | 33.2       | 18.6 | 2           | 8           |
| 92-AFB- 4107  | 9.5             | 1.0          | 8.5           | 196.2            | 171.6            | 24.6           | 16.1       | 8.5  | 4           | 24          |
| 92-AFB- 4108  | 8.3             | 0.4          | 7.9           | 247.5            | 212.5            | 35.0           | 25.8       | 9.2  | 3           | 57          |
| 92-AFB- 4109  | 8.7             | 0.8          | 7.9           | 390.6            | 305.6            | 85.0           | 50.5       | 34.5 | 0           | 0           |
| 92-AFB- 4110  | 8.2             | 1.0          | 7.2           | 150.6            | 127.9            | 22.7           | 14.4       | 8.3  | 0           | 0           |
| 92-AFB- 4111  | 8.7             | 1.3          | 7.4           | 197.8            | 149.2            | 48.6           | 35.2       | 13.4 | 1           | 29          |
| 92-AFB- 4112  | 8.6             | 1.2          | 7.4           | 269.7            | 238.7            | 31.0           | 20.0       | 11.0 | 2           | 23          |
| 92-AFB- 4113  | 10.1            | 2.4          | 7.8           | 275.0            | 207.0            | 68.0           | 47.4       | 20.6 | 7           | 101         |
| 92-AFB- 4114  | 9.8             | 2.0          | 7.9           | 348.0            | 291.3            | 56.7           | 35.2       | 21.5 | 2           | 151         |
| 92-AFB- 4115  | 10.5            | 1.7          | 8.9           | 272.2            | 205.4            | 66.8           | 39.4       | 27.4 | 4           | 94          |
| 92-AFB- 4116  | 9.6             | 1.7          | 7.9           | 308.1            | 264.6            | 43.5           | 26.1       | 17.4 | 6           | 373         |
| 92-AFB- 4117  | 9.6             | 2.0          | 7.6           | 234.3            | 182.7            | 51.6           | 35.2       | 16.4 | 12          | 66          |
| 92-AFB- 4118  | 10.7            | 2.4          | 8.4           | 193.3            | 164.9            | 28.4           | 15.8       | 12.6 | 1           | 24          |
| 92-AFB- 4119  | 8.7             | 1.1          | 7.6           | 94.2             | 76.9             | 17.3           | 8.0        | 9.3  | 0           | 0           |
| 92-AFB- 4120  | 9.3             | 1.9          | 7.4           | 146.1            | 121.2            | 24.9           | 15.2       | 9.7  | 0           | 0           |
| 92-AFB- 4121  | 8.5             | 1.8          | 6.8           | 236.5            | 216.8            | 19.7           | 12.2       | 7.5  | 5           | 136         |
| 92-AFB- 4122  | 10.8            | 1.4          | 9.5           | 212.2            | 160.2            | 52.0           | 33.1       | 18.9 | 8           | 81          |
| 92-AFB- 4123  | 9.7             | 2.6          | 7.1           | 217.9            | 176.4            | 41.5           | 24.8       | 16.7 | 9           | 83          |
| 92-AFB- 4124  | 8.5             | 1.8          | 6.7           | 196.6            | 160.2            | 36.4           | 22.1       | 14.3 | 5           | 31          |
| 92-AFB- 4125  | 9.2             | 1.4          | 7.8           | 220.0            | 192.4            | 27.6           | 16.4       | 11.2 | 3           | 80          |
| 92-AFB- 4126  | 7.9             | 0.7          | 7.3           | 197.1            | 181.7            | 15.4           | 9.0        | 6.4  | 4           | 9           |
| 92-AFB- 4127  | 8.2             | 1.4          | 6.8           | 173.7            | 150.3            | 23.4           | 13.4       | 10.0 | 0           | 0           |
| 92-AFB- 4128  | 9.0             | 1.4          | 7.7           | 237.9            | 218.5            | 19.4           | 15.8       | 3.6  | 5           | 30          |
| 92-AFB- 4129  | 6.6             | 1.4          | 5.2           | 129.4            | 110.3            | 19.1           | 10.5       | 8.6  | 6           | 248         |
| 92-AFB- 4130  | 8.0             | 1.5          | 6.6           | 215.4            | 194.3            | 21.1           | 10.8       | 10.3 | 2           | 15          |
| 92-AFB- 4131  | 8.6             | 2.6          | 6.1           | 160.2            | 135.6            | 24.6           | 12.8       | 11.8 | 2           | 4099        |
| 92-AFB- 4132  | 7.7             | 1.1          | 6.6           | 247.7            | 220.5            | 27.2           | 17.1       | 10.1 | 0           | 0           |
| 92-AFB- 4133  | 6.3             | 0.4          | 5.9           | 174.4            | 161.3            | 13.1           | 4.8        | 8.3  | 5           | 201         |
| 92-AFB- 4134  | 8.8             | 2.2          | 6.6           | 210.7            | 189.2            | 21.5           | 12.7       | 8.8  | 0           | 0           |
| 92-AFB- 4135  | 8.3             | 2.8          | 5.5           | 325.6            | 280.5            | 45.1           | 21.0       | 24.1 | 1           | 31          |
| 92-AFB- 4136  | 7.0             | 1.8          | 5.3           | 274.7            | 227.2            | 47.5           | 30.4       | 17.1 | 3           | 19          |
| 92-AFB- 4137  | 9.5             | 0.6          | 9.0           | 329.2            | 289.5            | 39.7           | 25.9       | 13.8 | 2           | 29          |
| 92-AFB- 4138  | 8.7             | 2.5          | 6.2           | 305.3            | 270.2            | 35.1           | 19.0       | 16.1 | 3           | 10          |

| SAMPLE NO.   | WEIGHT (KG WET) |           |            | WEIGHT (GMS DRY) |                  |             |         |      | GOLD     |          |
|--------------|-----------------|-----------|------------|------------------|------------------|-------------|---------|------|----------|----------|
|              | TABLE SPLIT     | +10 CHIPS | TABLE FEED | TABLE CONC       | M.I. CONCENTRATE |             |         |      | NO. V.G. | CALC PPB |
|              |                 |           |            |                  | M.I. LIGHTS      | CONC. TOTAL | NON MAG | MAG  |          |          |
| 92-AFB- 4139 | 7.4             | 1.3       | 6.1        | 179.9            | 172.4            | 7.5         | 4.4     | 3.1  | 5        | 372      |
| 92-AFB- 4140 | 8.6             | 1.8       | 6.8        | 168.8            | 138.5            | 30.3        | 15.9    | 14.4 | 4        | 406      |
| 92-AFB- 4141 | 8.5             | 2.0       | 6.5        | 183.2            | 155.2            | 28.0        | 13.8    | 14.2 | 1        | 14       |
| 92-AFB- 4142 | 8.4             | 2.2       | 6.2        | 226.4            | 195.1            | 31.3        | 15.8    | 15.5 | 0        | 0        |
| 92-AFB- 4143 | 8.5             | 2.0       | 6.5        | 230.3            | 208.0            | 22.3        | 13.2    | 9.1  | 0        | 0        |
| 92-AFB- 4144 | 7.7             | 1.8       | 6.0        | 159.3            | 126.9            | 32.4        | 11.3    | 21.1 | 1        | 89       |
| 92-AFB- 4145 | 8.6             | 1.2       | 7.4        | 177.0            | 153.4            | 23.6        | 15.3    | 8.3  | 3        | 138      |
| 92-AFB- 4146 | 8.5             | 1.8       | 6.8        | 280.0            | 245.3            | 34.7        | 21.8    | 12.9 | 5        | 363      |
| 92-AFB- 4147 | 9.2             | 1.8       | 7.4        | 156.7            | 148.1            | 8.6         | 5.6     | 3.0  | 3        | 618      |
| 92-AFB- 4148 | 7.7             | 1.5       | 6.3        | 126.6            | 120.2            | 6.4         | 3.6     | 2.8  | 0        | 0        |
| 92-AFB- 4149 | 8.6             | 1.3       | 7.3        | 197.7            | 173.2            | 24.5        | 15.2    | 9.3  | 8        | 245      |
| 92-AFB- 4150 | 7.3             | 0.3       | 7.0        | 153.6            | 145.7            | 7.9         | 3.3     | 4.6  | 1        | 25       |
| 92-AFB- 4151 | 9.0             | 2.3       | 6.8        | 236.2            | 215.1            | 21.1        | 10.9    | 10.2 | 3        | 147      |
| 92-AFB- 4152 | 8.9             | 2.9       | 6.0        | 277.0            | 249.0            | 28.0        | 14.0    | 14.0 | 0        | 0        |
| 92-AFB- 4153 | 8.6             | 2.0       | 6.6        | 290.2            | 254.4            | 35.8        | 17.2    | 18.6 | 2        | 33       |
| 92-AFB- 4154 | 8.9             | 1.3       | 7.6        | 289.9            | 243.4            | 46.5        | 26.8    | 19.7 | 2        | 21       |
| 92-AFB- 4155 | 8.5             | 1.7       | 6.9        | 201.4            | 164.9            | 36.5        | 14.3    | 22.2 | 3        | 20900    |
| 92-AFB- 4156 | 8.2             | 1.4       | 6.8        | 224.0            | 205.5            | 18.5        | 8.5     | 10.0 | 0        | 0        |
| 92-AFB- 4157 | 8.9             | 0.2       | 8.7        | 229.4            | 202.9            | 26.5        | 18.8    | 7.7  | 0        | 0        |
| 92-AFB- 4158 | 8.5             | 2.5       | 6.0        | 213.6            | 191.8            | 21.8        | 11.1    | 10.7 | 4        | 151      |
| 92-AFB- 4159 | 8.5             | 1.1       | 7.4        | 245.7            | 215.8            | 29.9        | 17.1    | 12.8 | 42       | 3905     |
| 92-AFB- 4160 | 10.0            | 1.4       | 8.6        | 251.9            | 215.0            | 36.9        | 22.0    | 14.9 | 7        | 137      |
| 92-AFB- 4161 | 9.3             | 2.2       | 7.1        | 195.8            | 162.0            | 33.8        | 18.9    | 14.9 | 16       | 49       |
| 92-AFB- 4162 | 9.2             | 2.4       | 6.8        | 242.1            | 210.5            | 31.6        | 18.3    | 13.3 | 10       | 147      |
| 92-AFB- 4163 | 8.8             | 1.5       | 7.3        | 125.1            | 91.6             | 33.5        | 21.9    | 11.6 | 1        | 17       |
| 92-AFB- 4164 | 7.9             | 1.2       | 6.7        | 235.4            | 210.2            | 25.2        | 12.9    | 12.3 | 6        | 290      |
| 92-AFB- 4165 | 8.9             | 2.8       | 6.1        | 134.1            | 107.1            | 27.0        | 12.6    | 14.4 | 1        | 6        |
| 92-AFB- 4166 | 8.5             | 1.2       | 7.3        | 132.5            | 105.8            | 26.7        | 17.0    | 9.7  | 19       | 625      |
| 92-AFB- 4167 | 8.3             | 1.7       | 6.6        | 124.3            | 113.9            | 10.4        | 6.8     | 3.6  | 6        | 47       |
| 92-AFB- 4168 | 9.3             | 2.7       | 6.6        | 157.9            | 122.6            | 35.3        | 24.1    | 11.2 | 5        | 188      |
| 92-AFB- 4169 | 8.6             | 1.8       | 6.8        | 204.5            | 177.2            | 27.3        | 18.8    | 8.5  | 12       | 106      |
| 92-AFB- 4170 | 8.9             | 1.5       | 7.5        | 207.9            | 190.7            | 17.2        | 11.0    | 6.2  | 9        | 263      |
| 92-AFB- 4171 | 8.4             | 0.7       | 7.8        | 216.6            | 161.1            | 55.5        | 40.2    | 15.3 | 11       | 163      |
| 92-AFB- 4172 | 8.2             | 1.6       | 6.6        | 213.1            | 184.1            | 29.0        | 18.6    | 10.4 | 8        | 3147     |
| 92-AFB- 4173 | 8.5             | 1.1       | 7.5        | 194.5            | 147.9            | 46.6        | 31.3    | 15.3 | 6        | 50       |
| 92-AFB- 4174 | 8.3             | 1.0       | 7.3        | 197.8            | 135.2            | 62.6        | 42.5    | 20.1 | 7        | 29       |
| 92-AFB- 4175 | 8.8             | 0.8       | 8.0        | 160.0            | 129.8            | 30.2        | 20.8    | 9.4  | 5        | 219      |
| 92-AFB- 4176 | 8.0             | 0.5       | 7.5        | 139.3            | 111.0            | 28.3        | 18.7    | 9.6  | 2        | 118      |
| 92-AFB- 4177 | 9.3             | 0.7       | 8.6        | 195.6            | 141.9            | 53.7        | 37.2    | 16.5 | 16       | 1928     |
| 92-AFB- 4178 | 9.3             | 1.7       | 7.6        | 106.6            | 78.3             | 28.3        | 19.8    | 8.5  | 19       | 666      |
| 92-AFB- 4179 | 9.1             | 1.1       | 8.0        | 225.8            | 186.3            | 39.5        | 26.6    | 12.9 | 4        | 19       |
| 92-AFB- 4180 | 9.2             | 1.0       | 8.2        | 153.7            | 135.5            | 18.2        | 12.2    | 6.0  | 2        | 18       |
| 92-AFB- 4181 | 8.8             | 0.8       | 8.0        | 261.9            | 207.2            | 54.7        | 37.2    | 17.5 | 27       | 1469     |
| 92-AFB- 4182 | 9.2             | 1.8       | 7.4        | 276.4            | 251.2            | 25.2        | 18.4    | 6.8  | 64       | 844      |
| 92-AFB- 4183 | 7.9             | 1.4       | 6.6        | 133.9            | 111.6            | 22.3        | 14.2    | 8.1  | 38       | 1000     |
| 92-AFB- 4184 | 8.6             | 1.3       | 7.3        | 258.0            | 218.9            | 39.1        | 28.2    | 10.9 | 15       | 67       |
| 92-AFB- 4185 | 9.6             | 2.5       | 7.1        | 423.2            | 372.7            | 50.5        | 35.0    | 15.5 | 18       | 127      |
| 92-AFB- 4186 | 8.2             | 0.8       | 7.4        | 188.9            | 159.1            | 29.8        | 20.4    | 9.4  | 22       | 190      |
| 92-AFB- 4187 | 9.2             | 2.0       | 7.2        | 129.6            | 108.1            | 21.5        | 15.4    | 6.1  | 12       | 88       |
| 92-AFB- 4188 | 8.8             | 1.2       | 7.6        | 226.4            | 188.7            | 37.7        | 26.0    | 11.7 | 20       | 645      |
| 92-AFB- 4189 | 7.9             | 0.8       | 7.2        | 154.5            | 125.6            | 28.9        | 20.0    | 8.9  | 6        | 204      |
| 92-AFB- 4190 | 8.6             | 0.7       | 7.9        | 184.6            | 164.5            | 20.1        | 18.4    | 1.7  | 3        | 205      |
| 92-AFB- 4191 | 8.7             | 1.5       | 7.2        | 180.9            | 137.9            | 43.0        | 29.7    | 13.3 | 11       | 361      |
| 92-AFB- 4192 | 8.9             | 2.2       | 6.7        | 115.7            | 87.5             | 28.2        | 20.4    | 7.8  | 4        | 63       |
| 92-AFB- 4193 | 8.4             | 1.9       | 6.5        | 232.1            | 205.6            | 26.5        | 19.8    | 6.7  | 5        | 18       |
| 92-AFB- 4194 | 9.6             | 1.8       | 7.8        | 186.4            | 148.9            | 37.5        | 25.4    | 12.1 | 93       | 1203     |
| 92-AFB- 4195 | 9.2             | 1.4       | 7.8        | 163.2            | 130.0            | 33.2        | 24.4    | 8.8  | 30       | 275      |
| 92-AFB- 4196 | 9.5             | 1.4       | 8.2        | 270.0            | 232.3            | 37.7        | 26.0    | 11.7 | 17       | 794      |
| 92-AFB- 4197 | 10.1            | 1.2       | 9.0        | 292.9            | 244.0            | 48.9        | 33.6    | 15.3 | 22       | 484      |
| 92-AFB- 4198 | 9.8             | 1.8       | 8.1        | 217.8            | 189.6            | 28.2        | 18.6    | 9.6  | 6        | 48       |
| 92-AFB- 4199 | 9.2             | 0.9       | 8.3        | 225.6            | 199.4            | 26.2        | 17.3    | 8.9  | 2        | 296      |

| SAMPLE<br>NO. | WEIGHT (KG WET) |              |               | WEIGHT (GMS DRY) |                  |                |            |      | GOLD        |             |
|---------------|-----------------|--------------|---------------|------------------|------------------|----------------|------------|------|-------------|-------------|
|               | TABLE<br>SPLIT  | +10<br>CHIPS | TABLE<br>FEED | TABLE<br>CONC    | M.I. CONCENTRATE |                |            |      | NO.<br>V.G. | CALC<br>PPB |
|               |                 |              |               |                  | M.I.<br>LIGHTS   | CONC.<br>TOTAL | NON<br>MAG | MAG  |             |             |
| 92-AFB- 4200  | 9.5             | 1.5          | 8.0           | 241.8            | 215.2            | 26.6           | 17.9       | 8.7  | 8           | 1278        |
| 92-AFB- 4201  | 10.8            | 2.9          | 7.9           | 249.4            | 211.4            | 38.0           | 24.2       | 13.8 | 2           | 50          |
| 92-AFB- 4202  | 8.3             | 1.8          | 6.5           | 207.3            | 196.1            | 11.2           | 6.5        | 4.7  | 1           | 4970        |
| 92-AFB- 4203  | 8.3             | 1.0          | 7.3           | 251.5            | 235.6            | 15.9           | 9.4        | 6.5  | 0           | 0           |
| 92-AFB- 4204  | 9.0             | 2.7          | 6.4           | 186.0            | 167.2            | 18.8           | 11.0       | 7.8  | 1           | 92          |
| 92-AFB- 4205  | 9.2             | 1.3          | 7.9           | 262.5            | 232.5            | 30.0           | 17.9       | 12.1 | 1           | 84          |
| 92-AFB- 4206  | 11.5            | 1.5          | 10.0          | 262.8            | 228.3            | 34.5           | 22.5       | 12.0 | 1           | 17          |
| 92-AFB- 4207  | 11.0            | 2.4          | 8.6           | 292.8            | 251.1            | 41.7           | 23.9       | 17.8 | 4           | 106         |
| 92-AFB- 4208  | 10.3            | 3.0          | 7.3           | 227.3            | 204.8            | 22.5           | 15.0       | 7.5  | 1           | 193         |
| 92-AFB- 4209  | 9.3             | 1.0          | 8.3           | 246.6            | 220.2            | 26.4           | 14.9       | 11.5 | 0           | 0           |
| 92-AFB- 4211  | 9.4             | 0.8          | 8.7           | 199.2            | 174.4            | 24.8           | 15.5       | 9.3  | 1           | 41          |
| 92-AFB- 4212  | 7.5             | 0.9          | 6.6           | 237.5            | 194.9            | 42.6           | 25.8       | 16.8 | 5           | 20          |
| 92-AFB- 4216  | 9.3             | 0.9          | 8.4           | 164.0            | 149.6            | 14.4           | 10.0       | 4.4  | 2           | 27          |
| 92-AFB- 4217  | 8.8             | 0.9          | 7.9           | 172.2            | 153.0            | 19.2           | 12.9       | 6.3  | 2           | 17          |
| 92-AFB- 4218  | 9.2             | 1.8          | 7.4           | 248.7            | 230.6            | 18.1           | 12.0       | 6.1  | 1           | 7           |
| 92-AFB- 4219  | 10.3            | 1.8          | 8.6           | 176.8            | 159.0            | 17.8           | 12.6       | 5.2  | 2           | 8           |
| 92-AFB- 4222  | 9.8             | 1.4          | 8.4           | 235.4            | 204.6            | 30.8           | 20.3       | 10.5 | 6           | 46          |
| 92-AFB- 4224  | 8.7             | 1.3          | 7.5           | 149.2            | 124.6            | 24.6           | 15.2       | 9.4  | 3           | 56          |
| 92-AFB- 4225  | 7.8             | 1.4          | 6.4           | 213.2            | 182.4            | 30.8           | 16.7       | 14.1 | 0           | 0           |
| 92-AFB- 4226  | 8.8             | 1.05         | 7.7           | 223.5            | 195.6            | 27.9           | 14.7       | 13.2 | 0           | 0           |
| 92-AFB- 4227  | 8.4             | 0.9          | 7.5           | 197.3            | 170.2            | 27.1           | 16.5       | 10.6 | 1           | 691         |
| 92-AFB- 4228  | 9.9             | 2.6          | 7.3           | 236.9            | 214.9            | 22.0           | 12.7       | 9.3  | 1           | 118         |
| 93-AFB- 4001  | 9.7             | 0.7          | 9.0           | 227.1            | 169.3            | 57.8           | 42.1       | 15.7 | 2           | 33          |
| 93-AFB- 4002  | 10.0            | 1.3          | 8.8           | 299.6            | 213.2            | 86.4           | 61.0       | 25.4 | 2           | 7           |
| 93-AFB- 4003  | 10.0            | 3.1          | 6.9           | 266.5            | 221.6            | 44.9           | 29.7       | 15.2 | 3           | 6           |
| 93-AFB- 4004  | 10.0            | 0.6          | 9.4           | 242.4            | 183.6            | 58.8           | 41.4       | 17.4 | 6           | 25          |
| 93-AFB- 4005  | 10.0            | 1.9          | 8.1           | 341.0            | 304.2            | 36.8           | 27.8       | 9.0  | 3           | 3477        |
| 93-AFB- 4006  | 9.5             | 1.2          | 8.3           | 263.0            | 214.6            | 48.4           | 32.0       | 16.4 | 1           | 1           |
| 93-AFB- 4007  | 10.0            | 0.9          | 9.1           | 190.9            | 161.5            | 29.4           | 22.0       | 7.4  | 0           | 0           |
| 93-AFB- 4008  | 9.9             | 0.8          | 9.1           | 253.1            | 200.8            | 52.3           | 35.0       | 17.3 | 4           | 11          |
| 93-AFB- 4009  | 8.0             | 1.7          | 6.4           | 286.5            | 227.3            | 59.2           | 41.0       | 18.2 | 9           | 172         |
| 93-AFB- 4010  | 10.0            | 2.9          | 7.1           | 422.3            | 369.3            | 53.0           | 37.2       | 15.8 | 2           | 6           |
| 93-AFB- 4011  | 9.1             | 1.2          | 8.0           | 177.3            | 158.1            | 19.2           | 13.0       | 6.2  | 2           | 165         |
| 93-AFB- 4012  | 8.6             | 0.8          | 7.8           | 217.2            | 174.5            | 42.7           | 28.1       | 14.6 | 26          | 275         |
| 93-AFB- 4013  | 9.8             | 0.8          | 9.1           | 308.1            | 259.5            | 48.6           | 32.4       | 16.2 | 2           | 3           |
| 93-AFB- 4014  | 10.0            | 1.3          | 8.7           | 213.2            | 164.5            | 48.7           | 34.7       | 14.0 | 13          | 16          |
| 93-AFB- 4015  | 9.4             | 0.8          | 8.6           | 312.3            | 269.5            | 42.8           | 31.1       | 11.7 | 2           | 1           |
| 93-AFB- 4016  | 10.0            | 1.6          | 8.4           | 338.9            | 277.2            | 61.7           | 51.7       | 10.0 | 7           | 23          |
| 93-AFB- 4017  | 9.5             | 1.6          | 8.0           | 275.5            | 256.8            | 18.7           | 15.6       | 3.1  | 24          | 191         |
| 93-AFB- 4018  | 9.6             | 2.0          | 7.6           | 200.9            | 169.1            | 31.8           | 26.7       | 5.1  | 5           | 2           |
| 93-AFB- 4019  | 7.9             | 1.5          | 6.5           | 187.1            | 159.5            | 27.6           | 18.0       | 9.6  | 9           | 142         |
| 93-AFB- 4020  | 10.4            | 2.2          | 8.3           | 243.5            | 213.0            | 30.5           | 20.4       | 10.1 | 3           | 32          |
| 93-AFB- 4021  | 10.0            | 1.8          | 8.2           | 266.1            | 223.4            | 42.7           | 29.3       | 13.4 | 3           | 31          |
| 93-AFB- 4022  | 10.4            | 2.0          | 8.4           | 263.3            | 225.3            | 38.0           | 24.5       | 13.5 | 2           | 11          |
| 93-AFB- 4023  | 10.7            | 2.0          | 8.8           | 546.6            | 504.3            | 42.3           | 29.0       | 13.3 | 40          | 203         |
| 93-AFB- 4024  | 10.0            | 1.7          | 8.3           | 318.4            | 273.2            | 45.2           | 31.3       | 13.9 | 6           | 45          |
| 93-AFB- 4025  | 10.0            | 1.4          | 8.6           | 340.1            | 283.8            | 56.3           | 39.3       | 17.0 | 3           | 3           |
| 93-AFB- 4026  | 7.0             | 1.3          | 5.7           | 142.5            | 122.9            | 19.6           | 14.3       | 5.3  | 4           | 90          |
| 93-AFB- 4027  | 10.0            | 1.5          | 8.5           | 213.8            | 184.2            | 29.6           | 14.9       | 14.7 | 2           | 7           |
| 93-AFB- 4028  | 10.3            | 1.9          | 8.5           | 256.7            | 205.0            | 51.7           | 34.3       | 17.4 | 0           | 0           |
| 93-AFB- 4029  | 11.0            | 1.2          | 9.8           | 266.6            | 230.1            | 36.5           | 26.3       | 10.2 | 4           | 40          |
| 93-AFB- 4030  | 10.5            | 2.1          | 8.4           | 205.9            | 176.6            | 29.3           | 15.0       | 14.3 | 1           | 2           |
| 93-AFB- 4031  | 9.5             | 1.7          | 7.8           | 267.3            | 231.9            | 35.4           | 18.8       | 16.6 | 3           | 54          |
| 93-AFB- 4032  | 10.0            | 1.5          | 8.5           | 299.5            | 235.2            | 64.3           | 44.1       | 20.2 | 4           | 39          |
| 93-AFB- 4033  | 10.0            | 1.3          | 8.7           | 208.0            | 173.4            | 34.6           | 22.2       | 12.4 | 7           | 63          |
| 93-AFB- 4034  | 10.7            | 2.2          | 8.5           | 206.9            | 182.0            | 24.9           | 10.8       | 14.1 | 3           | 70          |
| 93-AFB- 4035  | 10.9            | 2.4          | 8.5           | 180.1            | 126.4            | 53.7           | 38.2       | 15.5 | 4           | 4           |
| 93-AFB- 4036  | 9.3             | 2.1          | 7.2           | 208.2            | 157.3            | 50.9           | 25.1       | 25.8 | 16          | 260         |
| 93-AFB- 4037  | 7.0             | 1.6          | 5.4           | 125.5            | 104.0            | 21.5           | 11.3       | 10.2 | 1           | 7           |
| 93-AFB- 4038  | 7.7             | 2.2          | 5.5           | 124.5            | 102.6            | 21.9           | 20.8       | 1.1  | 1           | 31          |
| 93-AFB- 4039  | 9.1             | 2.7          | 6.4           | 229.4            | 184.4            | 45.0           | 15.0       | 30.0 | 3           | 46          |

| SAMPLE<br>NO. | WEIGHT (KG WET) |              |               | WEIGHT (GMS DRY) |                  |                |            |      | GOLD        |             |
|---------------|-----------------|--------------|---------------|------------------|------------------|----------------|------------|------|-------------|-------------|
|               | TABLE<br>SPLIT  | +10<br>CHIPS | TABLE<br>FEED | TABLE<br>CONC    | M.I. CONCENTRATE |                |            |      | NO.<br>V.G. | CALC<br>PPB |
|               |                 |              |               |                  | M.I.<br>LIGHTS   | CONC.<br>TOTAL | NON<br>MAG | MAG  |             |             |
| 93-AFB- 4040  | 10.1            | 3.2          | 6.9           | 198.1            | 178.0            | 20.1           | 12.4       | 7.7  | 3           | 48          |
| 93-AFB- 4041  | 10.0            | 1.7          | 8.4           | 350.8            | 301.4            | 49.4           | 26.8       | 22.6 | 0           | 0           |
| 93-AFB- 4042  | 8.6             | 2.5          | 6.1           | 227.0            | 208.6            | 18.4           | 13.1       | 5.3  | 2           | 8           |
| 93-AFB- 4043  | 10.0            | 1.3          | 8.8           | 330.7            | 274.0            | 56.7           | 34.9       | 21.8 | 2           | 16          |
| 93-AFB- 4044  | 10.2            | 2.5          | 7.7           | 402.5            | 344.3            | 58.2           | 26.9       | 31.3 | 4           | 117         |
| 93-AFB- 4045  | 10.0            | 1.7          | 8.3           | 225.2            | 172.4            | 52.8           | 30.4       | 22.4 | 4           | 42          |
| 93-AFB- 4046  | 9.5             | 1.1          | 8.4           | 321.2            | 301.7            | 19.5           | 12.6       | 6.9  | 3           | 37          |
| 93-AFB- 4047  | 9.9             | 1.9          | 8.0           | 204.8            | 179.3            | 25.5           | 15.0       | 10.5 | 5           | 116         |
| 93-AFB- 4048  | 9.6             | 2.2          | 7.4           | 216.5            | 189.3            | 27.2           | 18.3       | 8.9  | 20          | 510         |
| 93-AFB- 4049  | 9.7             | 1.5          | 8.2           | 212.2            | 189.9            | 22.3           | 16.5       | 5.8  | 7           | 38          |
| 93-AFB- 4050  | 10.0            | 1.2          | 8.8           | 226.4            | 196.4            | 30.0           | 23.4       | 6.6  | 12          | 296         |
| 93-AFB- 4051  | 9.7             | 0.8          | 8.9           | 238.1            | 222.0            | 16.1           | 10.4       | 5.7  | 1           | 18          |
| 93-AFB- 4052  | 10.0            | 2.5          | 7.5           | 250.9            | 206.4            | 44.5           | 26.7       | 17.8 | 7           | 101         |
| 93-AFB- 4053  | 10.6            | 2.2          | 8.4           | 316.0            | 247.2            | 68.8           | 47.0       | 21.8 | 2           | 15          |
| 93-AFB- 4054  | 9.0             | 1.2          | 7.8           | 192.9            | 166.6            | 26.3           | 16.5       | 9.8  | 0           | 0           |
| 93-AFB- 4055  | 10.0            | 2.2          | 7.9           | 191.2            | 140.6            | 50.6           | 32.7       | 17.9 | 2           | 20          |
| 93-AFB- 4056  | 10.3            | 1.3          | 9.1           | 271.4            | 211.8            | 59.6           | 36.3       | 23.3 | 2           | 30          |
| 93-AFB- 4057  | 10.0            | 1.7          | 8.3           | 209.7            | 182.9            | 26.8           | 19.1       | 7.7  | 7           | 121         |
| 93-AFB- 4058  | 10.0            | 2.0          | 8.0           | 207.8            | 157.8            | 50.0           | 28.7       | 21.3 | 2           | 23          |
| 93-AFB- 4061  | 8.7             | 1.9          | 6.8           | 248.3            | 196.8            | 51.5           | 36.0       | 15.5 | 1           | 897         |
| 93-AFB- 4062  | 10.0            | 2.7          | 7.3           | 313.3            | 259.0            | 54.3           | 37.7       | 16.6 | 0           | 0           |
| 93-AFB- 4063  | 10.4            | 3.6          | 6.8           | 205.1            | 160.9            | 44.2           | 21.4       | 22.8 | 2           | 26          |
| 93-AFB- 4064  | 9.3             | 1.2          | 8.1           | 182.6            | 168.0            | 14.6           | 10.0       | 4.6  | 1           | 19          |
| 93-AFB- 4065  | 10.5            | 1.6          | 8.9           | 131.6            | 112.4            | 19.2           | 13.0       | 6.2  | 7           | 91          |
| 93-AFB- 4066  | 9.3             | 2.7          | 6.6           | 189.6            | 165.1            | 24.5           | 18.4       | 6.1  | 0           | 0           |
| 93-AFB- 4068  | 9.4             | 1.7          | 7.7           | 287.5            | 238.2            | 49.3           | 25.6       | 23.7 | 7           | 2303        |
| 93-AFB- 4069  | 9.4             | 1.2          | 8.2           | 335.0            | 327.8            | 7.2            | 5.0        | 2.2  | 0           | 0           |
| 93-AFB- 4070  | 10.7            | 0.4          | 10.4          | 276.0            | 259.2            | 16.8           | 13.3       | 3.5  | 3           | 10          |
| 93-AFB- 4071  | 10.4            | 1.7          | 8.7           | 227.9            | 181.2            | 46.7           | 33.1       | 13.6 | 5           | 36          |
| 93-AFB- 4073  | 9.3             | 2.6          | 5.8           | 236.1            | 215.7            | 20.4           | 11.5       | 8.9  | 6           | 61          |
| 93-AFB- 4074  | 10.0            | 1.3          | 8.8           | 250.6            | 234.3            | 16.3           | 13.6       | 2.7  | 17          | 221         |
| 93-AFB- 4075  | 12.2            | 1.8          | 10.4          | 415.2            | 352.1            | 63.1           | 48.6       | 14.5 | 3           | 4           |
| 93-AFB- 4076  | 9.2             | 2.5          | 6.7           | 316.7            | 298.7            | 18.0           | 8.8        | 9.2  | 0           | 0           |
| 93-AFB- 4077  | 10.6            | 2.9          | 7.8           | 392.0            | 372.3            | 19.7           | 11.2       | 8.5  | 0           | 0           |
| 93-AFB- 4079  | 9.6             | 0.3          | 9.4           | 257.8            | 223.6            | 34.2           | 19.3       | 14.9 | 0           | 0           |
| 93-AFB- 4080  | 10.0            | 2.1          | 7.9           | 392.1            | 373.4            | 18.7           | 9.5        | 9.2  | 0           | 0           |
| 93-AFB- 4081  | 10.0            | 3.0          | 7.0           | 261.1            | 239.0            | 22.1           | 11.2       | 10.9 | 0           | 0           |
| 93-AFB- 4082  | 9.5             | 2.0          | 7.5           | 394.4            | 361.3            | 33.1           | 14.1       | 19.0 | 0           | 0           |
| 93-AFB- 4084  | 10.4            | 1.8          | 8.6           | 236.2            | 205.3            | 30.9           | 14.5       | 16.4 | 0           | 0           |
| 93-AFB- 4085  | 10.0            | 3.6          | 6.5           | 203.2            | 185.6            | 17.6           | 6.5        | 11.1 | 1           | 156         |
| 93-AFB- 4086  | 10.0            | 3.9          | 6.1           | 330.7            | 255.5            | 75.2           | 46.0       | 29.2 | 3           | 12          |
| 93-AFB- 4087  | 8.7             | 1.6          | 7.1           | 255.3            | 191.8            | 63.5           | 10.1       | 53.4 | 0           | 0           |
| 93-AFB- 4088  | 10.6            | 0.8          | 9.9           | 245.8            | 228.2            | 17.6           | 10.2       | 7.4  | 2           | 21          |
| 93-AFB- 4089  | 10.0            | 2.4          | 7.6           | 446.2            | 396.3            | 49.9           | 24.0       | 25.9 | 1           | 3           |
| 93-AFB- 4090  | 10.0            | 2.1          | 7.9           | 298.2            | 245.7            | 52.5           | 34.3       | 18.2 | 4           | 21          |
| 93-AFB- 4091  | 10.4            | 1.5          | 8.9           | 390.2            | 320.3            | 69.9           | 47.4       | 22.5 | 3           | 143         |
| 93-AFB- 4092  | 10.0            | 2.7          | 7.3           | 295.5            | 224.9            | 70.6           | 45.7       | 24.9 | 1           | 4           |
| 93-AFB- 4093  | 10.0            | 2.0          | 8.0           | 217.8            | 188.1            | 29.7           | 19.8       | 9.9  | 3           | 87          |
| 93-AFB- 4094  | 10.0            | 1.1          | 8.9           | 236.8            | 214.5            | 22.3           | 19.7       | 2.6  | 3           | 15          |
| 93-AFB- 4095  | 10.0            | 1.1          | 8.9           | 243.6            | 222.1            | 21.5           | 12.6       | 8.9  | 4           | 17          |
| 93-AFB- 4096  | 10.0            | 1.4          | 8.7           | 416.4            | 383.0            | 33.4           | 21.7       | 11.7 | 0           | 0           |
| 93-AFB- 4097  | 10.3            | 2.4          | 8.0           | 275.7            | 254.4            | 21.3           | 12.5       | 8.8  | 4           | 629         |
| 93-AFB- 4098  | 10.0            | 0.6          | 9.4           | 150.4            | 132.5            | 17.9           | 10.3       | 7.6  | 4           | 508         |
| 93-AFB- 4099  | 10.0            | 1.8          | 8.3           | 180.1            | 146.9            | 33.2           | 26.5       | 6.7  | 7           | 89          |
| 93-AFB- 4100  | 10.0            | 1.8          | 8.2           | 173.9            | 127.8            | 46.1           | 31.7       | 14.4 | 4           | 310         |
| 93-AFB- 4101  | 10.0            | 1.5          | 8.5           | 118.0            | 104.1            | 13.9           | 10.9       | 3.0  | 0           | 0           |
| 93-AFB- 4102  | 10.0            | 0.6          | 9.4           | 210.8            | 148.2            | 62.6           | 44.6       | 18.0 | 7           | 11          |
| 93-AFB- 4103  | 10.0            | 0.9          | 9.2           | 139.0            | 109.6            | 29.4           | 23.4       | 6.0  | 6           | 208         |
| 93-AFB- 4104  | 10.0            | 1.3          | 8.7           | 189.5            | 144.5            | 45.0           | 30.4       | 14.6 | 3           | 53          |
| 93-AFB- 4105  | 10.0            | 1.7          | 8.4           | 185.7            | 148.4            | 37.3           | 23.2       | 14.1 | 8           | 90          |
| 93-AFB- 4106  | 10.0            | 1.8          | 8.3           | 250.5            | 232.5            | 18.0           | 17.8       | 0.2  | 9           | 86          |



| SAMPLE NO.   | WEIGHT (KG WET) |           |            | WEIGHT (GMS DRY) |                  |             |         |      | GOLD     |          |
|--------------|-----------------|-----------|------------|------------------|------------------|-------------|---------|------|----------|----------|
|              | TABLE SPLIT     | +10 CHIPS | TABLE FEED | TABLE CONC       | M.I. CONCENTRATE |             |         |      | NO. V.G. | CALC PPB |
|              |                 |           |            |                  | M.I. LIGHTS      | CONC. TOTAL | NON MAG | MAG  |          |          |
| 93-AFB- 4107 | 10.0            | 1.7       | 8.3        | 288.6            | 251.1            | 37.5        | 23.8    | 13.7 | 2        | 19       |
| 93-AFB- 4108 | 10.0            | 1.5       | 8.5        | 219.9            | 145.4            | 74.5        | 33.1    | 41.4 | 2        | 14       |
| 93-AFB- 4109 | 10.0            | 2.8       | 7.2        | 208.1            | 177.3            | 30.8        | 14.1    | 16.7 | 1        | 6        |
| 93-AFB- 4110 | 8.6             | 2.4       | 6.3        | 141.7            | 114.0            | 27.7        | 16.6    | 11.1 | 0        | 0        |
| 93-AFB- 4111 | 10.0            | 1.6       | 8.5        | 358.2            | 212.2            | 146.0       | 89.4    | 56.6 | 3        | 8        |
| 93-AFB- 4112 | 10.0            | 2.2       | 7.8        | 173.9            | 141.7            | 32.2        | 20.9    | 11.3 | 13       | 690      |
| 93-AFB- 4113 | 10.0            | 1.0       | 9.0        | 100.5            | 83.9             | 16.6        | 14.2    | 2.4  | 0        | 0        |
| 93-AFB- 4114 | 10.0            | 1.4       | 8.6        | 275.5            | 207.8            | 67.7        | 47.8    | 19.9 | 6        | 16       |
| 93-AFB- 4115 | 10.7            | 1.4       | 9.3        | 120.3            | 92.2             | 28.1        | 21.5    | 6.6  | 3        | 1283     |
| 93-AFB- 4116 | 10.0            | 1.3       | 8.7        | 177.1            | 133.4            | 43.7        | 30.6    | 13.1 | 4        | 120      |
| 93-AFB- 4118 | 10.0            | 2.2       | 7.8        | 192.9            | 160.7            | 32.2        | 24.7    | 7.5  | 5        | 104      |
| 93-AFB- 4121 | 10.0            | 1.6       | 8.5        | 169.2            | 127.4            | 41.8        | 28.0    | 13.8 | 1        | 13       |
| 93-AFB- 4122 | 10.0            | 1.4       | 8.7        | 220.0            | 200.0            | 20.0        | 14.0    | 6.0  | 0        | 0        |
| 93-AFB- 4123 | 10.0            | 0.4       | 9.7        | 250.5            | 234.8            | 15.7        | 11.4    | 4.3  | 3        | 11       |
| 93-AFB- 4124 | 10.0            | 1.0       | 9.0        | 138.0            | 108.2            | 29.8        | 23.5    | 6.3  | 0        | 0        |
| 93-AFB- 4125 | 10.0            | 0.8       | 9.3        | 210.8            | 148.5            | 62.3        | 44.0    | 18.3 | 5        | 264      |
| 93-AFB- 4126 | 10.0            | 0.9       | 9.2        | 205.9            | 174.4            | 31.5        | 27.4    | 4.1  | 0        | 0        |
| 93-AFB- 4127 | 10.3            | 1.6       | 8.8        | 230.5            | 171.2            | 59.3        | 39.8    | 19.5 | 5        | 5        |
| 93-AFB- 4128 | 10.0            | 1.7       | 8.4        | 152.5            | 99.9             | 52.6        | 36.3    | 16.3 | 0        | 0        |
| 93-AFB- 4129 | 10.0            | 1.6       | 8.4        | 184.2            | 132.1            | 52.1        | 36.2    | 15.9 | 2        | 100      |
| 93-AFB- 4130 | 10.0            | 0.7       | 9.3        | 220.8            | 196.6            | 24.2        | 16.9    | 7.3  | 0        | 0        |
| 93-AFB- 4133 | 10.0            | 0.6       | 9.5        | 281.1            | 232.1            | 49.0        | 26.4    | 22.6 | 2        | 4        |
| 93-AFB- 4146 | 10.0            | 1.9       | 8.2        | 171.4            | 141.8            | 29.6        | 22.6    | 7.0  | 18       | 217      |
| 93-AFB- 4147 | 10.0            | 2.2       | 7.9        | 140.8            | 101.3            | 39.5        | 26.0    | 13.5 | 4        | 67       |
| 93-AFB- 4149 | 10.0            | 2.2       | 7.8        | 174.3            | 136.3            | 38.0        | 25.3    | 12.7 | 5        | 4655     |
| 93-AFB- 4150 | 10.0            | 1.7       | 8.4        | 208.9            | 170.4            | 38.5        | 26.5    | 12.0 | 3        | 15       |
| 93-AFB- 4152 | 10.8            | 1.2       | 9.7        | 165.5            | 136.6            | 28.9        | 26.8    | 2.1  | 0        | 0        |
| 93-AFB- 4154 | 10.0            | 1.1       | 8.9        | 221.5            | 174.3            | 47.2        | 32.2    | 15.0 | 14       | 70       |
| 93-AFB- 4155 | 10.0            | 1.1       | 8.9        | 230.2            | 209.6            | 20.6        | 17.9    | 2.7  | 1        | 4559     |
| 93-AFB- 4156 | 10.6            | 1.6       | 9.0        | 240.1            | 212.0            | 28.1        | 23.6    | 4.5  | 7        | 431      |
| 93-AFB- 4157 | 10.0            | 3.5       | 6.6        | 236.3            | 201.8            | 34.5        | 19.3    | 15.2 | 3        | 7        |
| 93-AFB- 4158 | 10.0            | 1.7       | 8.4        | 192.1            | 153.6            | 38.5        | 25.3    | 13.2 | 7        | 23       |
| 93-AFB- 4159 | 10.0            | 2.2       | 7.9        | 221.6            | 160.5            | 61.1        | 41.4    | 19.7 | 5        | 45       |
| 93-AFB- 4170 | 10.0            | 1.8       | 8.2        | 238.7            | 198.7            | 40.0        | 25.1    | 14.9 | 9        | 8927     |
| 93-AFB- 4171 | 10.0            | 2.2       | 7.9        | 266.8            | 203.0            | 63.8        | 44.0    | 19.8 | 1        | 15       |
| 93-AFB- 4172 | 10.0            | 2.8       | 7.3        | 256.8            | 203.4            | 53.4        | 38.7    | 14.7 | 1        | 10       |
| 93-AFB- 4173 | 10.0            | 1.5       | 8.6        | 173.3            | 134.2            | 39.1        | 25.7    | 13.4 | 4        | 914      |
| 93-AFB- 4174 | 10.0            | 1.3       | 8.7        | 244.2            | 190.7            | 53.5        | 37.2    | 16.3 | 3        | 17       |
| 93-AFB- 4175 | 10.8            | 4.3       | 6.6        | 211.9            | 174.6            | 37.3        | 23.9    | 13.4 | 1        | 3        |
| 93-AFB- 4176 | 10.0            | 1.6       | 8.4        | 229.4            | 191.8            | 37.6        | 20.2    | 17.4 | 4        | 92       |
| 93-AFB- 4178 | 10.0            | 1.3       | 8.8        | 209.1            | 175.5            | 33.6        | 15.1    | 18.5 | 2        | 92       |
| 93-AFB- 4179 | 10.0            | 1.8       | 8.3        | 143.1            | 120.1            | 23.0        | 13.8    | 9.2  | 3        | 705      |
| 93-AFB- 4180 | 10.0            | 1.7       | 8.4        | 216.9            | 166.8            | 50.1        | 30.4    | 19.7 | 24       | 394      |
| 93-AFB- 4181 | 10.0            | 1.7       | 8.3        | 210.4            | 145.9            | 64.5        | 32.5    | 32.0 | 2        | 22       |
| 93-AFB- 4182 | 10.0            | 2.0       | 8.0        | 286.8            | 239.6            | 47.2        | 30.9    | 16.3 | 3        | 26       |
| 93-AFB- 4184 | 9.8             | 3.0       | 6.8        | 154.0            | 113.9            | 40.1        | 30.6    | 9.5  | 1        | 6        |
| 93-AFB- 4186 | 8.9             | 0.8       | 8.1        | 272.6            | 201.8            | 70.8        | 28.2    | 42.6 | 8        | 52       |
| 93-AFB- 4187 | 10.0            | 2.8       | 7.3        | 326.9            | 245.6            | 81.3        | 46.0    | 35.3 | 3        | 19       |
| 93-AFB- 4189 | 10.0            | 5.0       | 5.1        | 190.6            | 153.2            | 37.4        | 17.6    | 19.8 | 1        | 57       |
| 93-AFB- 4190 | 7.6             | 2.4       | 5.2        | 207.9            | 164.4            | 43.5        | 22.8    | 20.7 | 1        | 4        |
| 93-AFB- 4191 | 7.6             | 2.1       | 5.5        | 246.7            | 159.4            | 87.3        | 34.0    | 53.3 | 3        | 479      |
| 93-AFB- 4192 | 6.3             | 1.0       | 5.3        | 180.7            | 148.4            | 32.3        | 14.9    | 17.4 | 3        | 98       |
| 93-AFB- 4193 | 7.6             | 1.6       | 6.0        | 196.7            | 141.1            | 55.6        | 35.0    | 20.6 | 1        | 0        |
| 93-AFB- 4194 | 6.9             | 1.8       | 5.1        | 201.0            | 179.1            | 21.9        | 11.6    | 10.3 | 1        | 667      |
| 93-AFB- 4195 | 5.3             | 0.4       | 4.9        | 126.9            | 122.1            | 4.8         | 3.4     | 1.4  | 1        | 188      |
| 93-AFB- 4196 | 7.9             | 1.8       | 6.2        | 216.7            | 190.5            | 26.2        | 15.2    | 11.0 | 0        | 0        |
| 93-AFB- 4197 | 6.2             | 0.9       | 5.3        | 245.0            | 218.4            | 26.6        | 16.4    | 10.2 | 2        | 2        |
| 93-AFB- 4198 | 6.6             | 1.3       | 5.3        | 155.6            | 139.8            | 15.8        | 9.4     | 6.4  | 1        | 9        |
| 93-AFB- 4199 | 5.7             | 0.3       | 5.4        | 182.1            | 136.3            | 45.8        | 29.3    | 16.5 | 2        | 14       |
| 93-AFB- 4200 | 7.7             | 2.4       | 5.3        | 146.3            | 93.4             | 52.9        | 29.3    | 23.6 | 5        | 36       |
| 93-AFB- 4201 | 6.9             | 2.4       | 4.6        | 121.7            | 99.0             | 22.7        | 7.8     | 14.9 | 2        | 28       |



| SAMPLE<br>NO. | WEIGHT (KG WET) |              |               | WEIGHT (GMS DRY) |                  |                |            |      | GOLD        |             |
|---------------|-----------------|--------------|---------------|------------------|------------------|----------------|------------|------|-------------|-------------|
|               | TABLE<br>SPLIT  | +10<br>CHIPS | TABLE<br>FEED | TABLE<br>CONC    | M.I. CONCENTRATE |                |            |      | NO.<br>V.G. | CALC<br>PPB |
|               |                 |              |               |                  | M.I.<br>LIGHTS   | CONC.<br>TOTAL | NON<br>MAG | MAG  |             |             |
| 93-AFB- 4202  | 7.0             | 2.1          | 4.9           | 278.8            | 210.0            | 68.8           | 40.6       | 28.2 | 3           | 32          |
| 93-AFB- 4203  | 7.0             | 1.0          | 6.0           | 326.3            | 281.1            | 45.2           | 28.0       | 17.2 | 2           | 43          |
| 93-AFB- 4205  | 6.3             | 0.9          | 5.4           | 159.0            | 146.1            | 12.9           | 7.1        | 5.8  | 2           | 154         |
| 93-AFB- 4206  | 6.7             | 0.3          | 6.4           | 192.9            | 155.6            | 37.3           | 22.1       | 15.2 | 15          | 148         |
| 93-AFB- 4207  | 5.8             | 1.1          | 4.7           | 118.5            | 111.1            | 7.4            | 4.0        | 3.4  | 1           | 48          |
| 93-AFB- 4208  | 5.8             | 2.1          | 3.7           | 185.2            | 174.3            | 10.9           | 6.2        | 4.7  | 1           | 13          |
| 93-AFB- 4209  | 7.8             | 1.6          | 6.2           | 269.2            | 242.0            | 27.2           | 19.6       | 7.6  | 0           | 0           |
| 93-AFB- 4210  | 7.0             | 1.3          | 5.8           | 264.3            | 242.8            | 21.5           | 10.7       | 10.8 | 1           | 8           |
| 93-AFB- 4211  | 7.2             | 1.0          | 6.2           | 237.6            | 207.7            | 29.9           | 17.9       | 12.0 | 1           | 11          |
| 93-AFB- 4212  | 6.6             | 0.6          | 6.0           | 214.1            | 175.0            | 39.1           | 22.8       | 16.3 | 36          | 704         |
| 93-AFB- 4213  | 6.5             | 0.7          | 5.8           | 160.1            | 135.8            | 24.3           | 11.5       | 12.8 | 0           | 0           |
| 93-AFB- 4214  | 7.5             | 1.0          | 6.5           | 219.5            | 187.2            | 32.3           | 21.1       | 11.2 | 8           | 127         |
| 93-AFB- 4215  | 8.0             | 2.0          | 6.0           | 194.8            | 158.0            | 36.8           | 19.6       | 17.2 | 6           | 295         |
| 93-AFB- 4216  | 7.6             | 1.8          | 5.8           | 291.0            | 271.6            | 19.4           | 9.3        | 10.1 | 0           | 0           |
| 93-AFB- 4217  | 8.1             | 1.8          | 6.4           | 211.6            | 165.5            | 46.1           | 26.4       | 19.7 | 4           | 43          |
| 93-AFB- 4218  | 7.6             | 1.8          | 5.8           | 133.4            | 98.1             | 35.3           | 19.4       | 15.9 | 5           | 96          |
| 93-AFB- 4219  | 8.0             | 2.0          | 6.0           | 197.5            | 156.8            | 40.7           | 22.7       | 18.0 | 3           | 45          |
| 93-AFB- 4220  | 7.4             | 1.0          | 6.4           | 259.5            | 235.5            | 24.0           | 14.8       | 9.2  | 4           | 64          |
| 93-AFB- 4221  | 7.5             | 1.4          | 6.1           | 182.6            | 159.2            | 23.4           | 13.9       | 9.5  | 1           | 46          |
| 93-AFB- 4222  | 7.3             | 1.5          | 5.8           | 168.2            | 153.0            | 15.2           | 7.6        | 7.6  | 5           | 1714        |
| 93-AFB- 4223  | 7.7             | 1.6          | 6.1           | 243.1            | 218.3            | 24.8           | 12.4       | 12.4 | 2           | 311         |
| 93-AFB- 4225  | 6.0             | 1.0          | 5.0           | 173.7            | 146.7            | 27.0           | 13.5       | 13.5 | 14          | 235         |
| 93-AFB- 4226  | 7.0             | 1.3          | 5.8           | 184.8            | 167.0            | 17.8           | 8.9        | 8.9  | 2           | 114         |
| 93-AFB- 4227  | 6.2             | 0.6          | 5.6           | 165.5            | 138.7            | 26.8           | 13.4       | 13.4 | 4           | 148         |
| 93-AFB- 4228  | 8.5             | 2.4          | 6.1           | 233.3            | 192.7            | 40.6           | 20.3       | 20.3 | 5           | 182         |
| 93-AFB- 4229  | 5.4             | 0.6          | 4.8           | 142.1            | 132.1            | 10.0           | 5.2        | 4.8  | 2           | 954         |

**Appendix C. Detailed particulate gold grain data.**

| SAMPLE #     | PANNED<br>Y/N | DIAMETER (μm) | NUMBER OF GRAINS |     |          |     |          |     |       |    |
|--------------|---------------|---------------|------------------|-----|----------|-----|----------|-----|-------|----|
|              |               |               | RESHAPED         |     | MODIFIED |     | PRISTINE |     | TOTAL |    |
|              |               |               | Table            | Pan | Table    | Pan | Table    | Pan |       |    |
| 92-AFB- 4001 | N             | 25 X 25       | 2                |     |          |     |          |     |       | 2  |
|              |               | 25 X 50       | 1                |     |          |     |          |     |       | 1  |
|              |               | 75 X 100      | 1                |     |          |     |          |     |       | 1  |
|              |               | 100 X 100     | 1                |     |          |     |          |     |       | 1  |
|              |               | 125 X 175     | 1                |     |          |     |          |     |       | 1  |
|              |               |               |                  |     |          |     |          |     |       | 6  |
| 92-AFB- 4002 | N             | 25 X 25       | 2                |     |          |     |          |     |       | 2  |
|              |               | 50 X 75       | 1                |     |          |     |          |     |       | 1  |
|              |               | 50 X 100      | 1                |     |          |     |          |     |       | 1  |
|              |               | 100 X 125     | 1                |     |          |     |          |     |       | 1  |
|              |               |               |                  |     |          |     |          |     |       | 5  |
| 92-AFB- 4003 | N             | 25 X 25       | 2                |     |          |     |          |     |       | 2  |
|              |               | 50 X 125      | 1                |     |          |     |          |     |       | 1  |
|              |               |               |                  |     |          |     |          |     |       | 3  |
| 92-AFB- 4006 | N             | 25 X 50       | 1                |     |          |     |          |     |       | 1  |
|              |               | 50 X 100      | 1                |     |          |     |          |     |       | 1  |
|              |               | 150 X 250     | 1                |     |          |     |          |     |       | 1  |
|              |               |               |                  |     |          |     |          |     |       | 3  |
| 92-AFB- 4007 | N             | 15 X 15       | 1                |     |          |     |          |     |       | 1  |
|              |               | 25 X 25       | 1                |     |          |     |          |     |       | 1  |
|              |               | 25 X 50       | 1                |     |          |     |          |     |       | 1  |
|              |               | 25 X 75       | 1                |     |          |     |          |     |       | 1  |
|              |               | 50 X 75       | 1                |     |          |     |          |     |       | 1  |
|              |               |               |                  |     |          |     |          |     |       | 5  |
| 92-AFB- 4009 | N             | 15 X 15       | 1                |     |          |     |          |     |       | 1  |
|              |               | 25 X 25       | 3                |     |          |     |          |     |       | 3  |
|              |               | 25 X 50       |                  |     |          |     | 1        |     |       | 1  |
|              |               | 50 X 50       | 1                |     |          |     |          |     |       | 1  |
|              |               | 50 X 75       | 1                |     |          |     |          |     |       | 1  |
|              |               | 50 X 100      | 1                |     |          |     |          |     |       | 1  |
|              |               | 75 X 100      | 1                |     |          |     |          |     |       | 1  |
|              |               |               |                  |     |          |     |          |     |       | 9  |
| 92-AFB- 4011 | N             | 25 X 50       | 1                |     |          |     |          |     |       | 1  |
|              |               | 25 X 125      | 1                |     |          |     |          |     |       | 1  |
|              |               | 50 X 75       | 1                |     |          |     | 1        |     |       | 2  |
|              |               | 50 X 100      | 1                |     |          |     |          |     |       | 1  |
|              |               | 50 X 150      | 1                |     |          |     |          |     |       | 1  |
|              |               | 75 X 110      | 1                |     |          |     |          |     |       | 1  |
|              |               |               |                  |     |          |     |          |     |       | 7  |
| 92-AFB- 4012 | Y             | 25 X 25       | 1                | 1   |          |     |          |     |       | 2  |
|              |               | 25 X 50       | 3                |     |          |     |          |     |       | 3  |
|              |               | 50 X 50       | 2                |     |          |     |          |     |       | 2  |
|              |               | 50 X 75       | 2                |     |          |     |          |     |       | 2  |
|              |               | 75 X 100      | 1                |     |          |     |          |     |       | 1  |
|              |               | 175 X 225     | 1                |     |          |     |          |     |       | 1  |
|              |               | 225 X 300     | 1                |     |          |     |          |     |       | 1  |
|              |               |               |                  |     |          |     |          |     |       | 12 |
| 92-AFB- 4014 | N             | 100 X 125     | 1                |     |          |     |          |     |       | 1  |
|              |               | 125 X 150     | 1                |     |          |     |          |     |       | 1  |
|              |               |               |                  |     |          |     |          |     |       | 2  |
| 92-AFB- 4015 | N             | 25 X 50       | 1                |     |          |     |          |     |       | 1  |
|              |               | 50 X 50       | 1                |     |          |     |          |     |       | 1  |
|              |               | 50 X 75       | 1                |     |          |     |          |     |       | 1  |
|              |               | 75 X 100      | 1                |     |          |     |          |     |       | 1  |
|              |               | 100 X 150     | 1                |     |          |     |          |     |       | 1  |
|              |               |               |                  |     |          |     |          |     |       | 5  |
| 92-AFB- 4016 | N             | 25 X 25       | 1                |     |          |     |          |     |       | 1  |
|              |               |               |                  |     |          |     |          |     |       | 1  |

| SAMPLE #     | PANNED<br>Y/N | DIAMETER (μm) | NUMBER OF GRAINS |     |          |     |          |     |       |  |
|--------------|---------------|---------------|------------------|-----|----------|-----|----------|-----|-------|--|
|              |               |               | RESHAPED         |     | MODIFIED |     | PRISTINE |     | TOTAL |  |
|              |               |               | Table            | Pan | Table    | Pan | Table    | Pan |       |  |
| 92-AFB- 4017 | N             | 50 X 125      | 1                |     |          |     |          |     | 1     |  |
|              |               | 75 X 100      | 1                |     |          |     |          |     | 1     |  |
|              |               | 150 X 275     | 1                |     |          |     |          |     | 1     |  |
|              |               |               |                  |     |          |     |          |     | 3     |  |
| 92-AFB- 4019 | N             | 75 X 100      | 1                |     |          |     |          |     | 1     |  |
|              |               |               |                  |     |          |     |          |     | 1     |  |
| 92-AFB- 4020 | N             | 25 X 50       | 2                |     |          |     |          |     | 2     |  |
|              |               |               |                  |     |          |     |          |     | 2     |  |
| 92-AFB- 4021 | N             | 50 X 50       | 1                |     |          |     |          |     | 1     |  |
|              |               |               |                  |     |          |     |          |     | 1     |  |
| 92-AFB- 4022 | N             | 25 X 75       | 1                |     |          |     |          |     | 1     |  |
|              |               |               |                  |     |          |     |          |     | 1     |  |
| 92-AFB- 4023 | N             | 50 X 75       | 1                |     |          |     |          |     | 1     |  |
|              |               |               |                  |     |          |     |          |     | 1     |  |
| 92-AFB- 4024 | N             | 50 X 75       | 1                |     |          |     |          |     | 1     |  |
|              |               | 75 X 100      | 1                |     |          |     |          |     | 1     |  |
|              |               |               |                  |     |          |     |          |     | 2     |  |
| 92-AFB- 4025 | N             | 50 X 75       | 1                |     |          |     |          |     | 1     |  |
|              |               | 50 X 100      | 1                |     |          |     |          |     | 1     |  |
|              |               | 125 X 200     | 1                |     |          |     |          |     | 1     |  |
|              |               |               |                  |     |          |     |          |     | 3     |  |
| 92-AFB- 4027 | N             | 50 X 100      | 1                |     |          |     |          |     | 1     |  |
|              |               |               |                  |     |          |     |          |     | 1     |  |
| 92-AFB- 4028 | N             | 50 X 50       | 1                |     |          |     |          |     | 1     |  |
|              |               | 125 X 150     | 1                |     |          |     |          |     | 1     |  |
|              |               | 125 X 225     | 1                |     |          |     |          |     | 1     |  |
|              |               | 200 X 275     | 1                |     |          |     |          |     | 1     |  |
|              |               |               |                  |     |          |     |          |     | 4     |  |
| 92-AFB- 4029 | N             | 25 X 25       |                  |     |          |     | 1        |     | 1     |  |
|              |               | 50 X 50       | 1                |     |          |     |          |     | 1     |  |
|              |               |               |                  |     |          |     |          |     | 2     |  |
| 92-AFB- 4031 | Y             | 15 X 15       | 2                | 1   |          |     | 1        |     | 4     |  |
|              |               | 25 X 25       | 4                | 2   |          |     | 1        |     | 7     |  |
|              |               | 25 X 50       | 7                |     |          |     |          |     | 7     |  |
|              |               | 25 X 75       | 1                |     |          |     |          |     | 1     |  |
|              |               | 25 X 100      |                  |     | 1        |     |          |     | 1     |  |
|              |               | 50 X 50       | 1                |     |          |     |          |     | 1     |  |
|              |               | 50 X 75       | 1                |     |          |     |          |     | 1     |  |
|              |               | 50 X 100      | 1                |     |          |     |          |     | 1     |  |
|              |               |               |                  |     |          |     |          |     | 23    |  |
| 92-AFB- 4032 | N             | 15 X 15       |                  |     |          |     | 1        |     | 1     |  |
|              |               | 25 X 25       | 3                |     |          |     |          |     | 3     |  |
|              |               | 50 X 50       | 1                |     |          |     |          |     | 1     |  |
|              |               | 50 X 75       | 1                |     |          |     |          |     | 1     |  |
|              |               |               |                  |     |          |     |          |     | 6     |  |
| 92-AFB- 4033 | N             | NO V.G.       |                  |     |          |     |          |     |       |  |
| 92-AFB- 4034 | N             | 25 X 25       | 1                |     |          |     |          |     | 1     |  |
|              |               |               |                  |     |          |     |          |     | 1     |  |
| 92-AFB- 4036 | N             | NO V.G.       |                  |     |          |     |          |     |       |  |
| 92-AFB- 4037 | N             | 25 X 25       | 1                |     |          |     |          |     | 1     |  |
|              |               | 50 X 50       | 1                |     |          |     |          |     | 1     |  |
|              |               | 50 X 75       | 1                |     |          |     |          |     | 1     |  |
|              |               |               |                  |     |          |     |          |     | 3     |  |

| SAMPLE #     | PANNED<br>Y/N | DIAMETER (μm) | NUMBER OF GRAINS |     |          |     |          |     |       |  |
|--------------|---------------|---------------|------------------|-----|----------|-----|----------|-----|-------|--|
|              |               |               | RESHAPED         |     | MODIFIED |     | PRISTINE |     | TOTAL |  |
|              |               |               | Table            | Pan | Table    | Pan | Table    | Pan |       |  |
| 92-AFB- 4038 | N             | 50 X 50       | 1                |     |          |     |          |     | 1     |  |
|              |               | 75 X 125      | 1                |     |          |     |          |     | 1     |  |
|              |               | 150 X 175     | 1                |     |          |     |          |     | 1     |  |
|              |               |               |                  |     |          |     |          |     | 3     |  |
| 92-AFB- 4039 | N             | 50 X 50       | 1                |     |          |     |          |     | 1     |  |
|              |               |               |                  |     |          |     |          |     | 1     |  |
| 92-AFB- 4040 | N             | 25 X 25       | 1                |     |          |     |          |     | 1     |  |
|              |               |               |                  |     |          |     |          |     | 1     |  |
| 92-AFB- 4041 | N             | 50 X 50       | 1                |     |          |     |          |     | 1     |  |
|              |               | 50 X 75       | 1                |     |          |     |          |     | 1     |  |
|              |               |               |                  |     |          |     |          |     | 2     |  |
| 92-AFB- 4043 | N             | NO V.G.       |                  |     |          |     |          |     |       |  |
| 92-AFB- 4044 | N             | NO V.G.       |                  |     |          |     |          |     |       |  |
| 92-AFB- 4047 | N             | NO V.G.       |                  |     |          |     |          |     |       |  |
| 92-AFB- 4048 | N             | 150 X 150     | 1                |     |          |     |          |     | 1     |  |
|              |               |               |                  |     |          |     |          |     | 1     |  |
| 92-AFB- 4049 | N             | 25 X 100      | 1                |     |          |     |          |     | 1     |  |
|              |               |               |                  |     |          |     |          |     | 1     |  |
| 92-AFB- 4050 | N             | NO V.G.       |                  |     |          |     |          |     |       |  |
| 92-AFB- 4051 | N             | 50 X 50       | 1                |     |          |     |          |     | 1     |  |
|              |               | 50 X 75       | 1                |     |          |     |          |     | 1     |  |
|              |               | 100 X 175     | 1                |     |          |     |          |     | 1     |  |
|              |               |               |                  |     |          |     |          |     | 3     |  |
| 92-AFB- 4052 | N             | NO V.G.       |                  |     |          |     |          |     |       |  |
| 92-AFB- 4055 | N             | NO V.G.       |                  |     |          |     |          |     |       |  |
| 92-AFB- 4056 | N             | 50 X 50       | 1                |     |          |     |          |     | 1     |  |
|              |               | 50 X 75       | 1                |     |          |     |          |     | 1     |  |
|              |               | 75 X 75       | 1                |     |          |     |          |     | 1     |  |
|              |               |               |                  |     |          |     |          |     | 3     |  |
| 92-AFB- 4058 | N             | 75 X 125      | 1                |     |          |     |          |     | 1     |  |
|              |               |               |                  |     |          |     |          |     | 1     |  |
| 92-AFB- 4059 | N             | 25 X 50       |                  |     |          |     | 1        |     | 1     |  |
|              |               | 50 X 75       | 1                |     |          |     |          |     | 1     |  |
|              |               |               |                  |     |          |     |          |     | 2     |  |
| 92-AFB- 4060 | Y             | 15 X 15       |                  |     |          |     |          | 3   | 3     |  |
|              |               | 25 X 25       | 1                | 4   |          | 1   | 1        |     | 7     |  |
|              |               | 25 X 50       | 1                | 2   |          |     | 3        |     | 6     |  |
|              |               | 25 X 75       | 2                |     |          | 1   |          |     | 3     |  |
|              |               | 25 X 125      | 1                |     |          |     |          |     | 1     |  |
|              |               | 50 X 75       | 1                |     |          |     |          |     | 1     |  |
|              |               | 50 X 100      | 1                |     |          |     |          |     | 1     |  |
|              |               | 50 X 175      |                  | 1   |          |     |          |     | 1     |  |
|              |               | 75 X 100      | 1                |     |          |     |          |     | 1     |  |
|              |               |               |                  |     |          |     |          |     | 24    |  |
| 92-AFB- 4061 | N             | 25 X 25       | 3                |     |          |     | 1        |     | 4     |  |
|              |               | 25 X 50       | 2                |     |          |     |          |     | 2     |  |
|              |               | 50 X 50       | 1                |     |          |     |          |     | 1     |  |
|              |               | 50 X 75       | 2                |     |          |     |          |     | 2     |  |
|              |               |               |                  |     |          |     |          |     | 9     |  |



| SAMPLE #     | PANNED<br>Y/N | DIAMETER (µm) | NUMBER OF GRAINS |     |          |     |          |     |       |
|--------------|---------------|---------------|------------------|-----|----------|-----|----------|-----|-------|
|              |               |               | RESHAPED         |     | MODIFIED |     | PRISTINE |     | TOTAL |
|              |               |               | Table            | Pan | Table    | Pan | Table    | Pan |       |
| 92-AFB- 4062 | Y             | 15 X 15       |                  |     |          |     | 1        |     | 1     |
|              |               | 25 X 25       | 3                | 1   |          |     | 1        |     | 5     |
|              |               | 25 X 50       | 4                | 1   | 2        |     |          |     | 7     |
|              |               | 25 X 75       | 2                |     | 2        |     |          |     | 4     |
|              |               | 50 X 100      |                  | 1   |          |     |          |     | 1     |
|              |               | 75 X 125      |                  | 1   |          |     |          |     | 1     |
|              |               |               |                  |     |          |     |          |     | 19    |
| 92-AFB- 4063 | Y             | 15 X 15       | 1                |     |          |     | 1        |     | 2     |
|              |               | 25 X 25       | 3                |     |          |     | 1        |     | 4     |
|              |               | 25 X 50       | 2                |     |          | 2   | 2        |     | 6     |
|              |               | 25 X 75       | 1                |     |          |     |          |     | 1     |
|              |               | 50 X 50       | 1                |     |          |     |          |     | 1     |
|              |               | 75 X 100      | 1                |     |          |     |          |     | 1     |
|              |               | 75 X 150      | 1                |     |          |     |          |     | 1     |
| 92-AFB- 4064 | N             | 15 X 15       |                  |     |          |     | 2        |     | 2     |
|              |               | 25 X 25       | 2                |     |          |     | 1        |     | 3     |
|              |               | 50 X 75       | 1                |     |          |     |          |     | 1     |
|              |               |               |                  |     |          |     |          |     | 6     |
| 92-AFB- 4065 | N             | 25 X 75       | 1                |     |          |     |          |     | 1     |
|              |               | 50 X 100      | 1                |     |          |     |          |     | 1     |
|              |               |               |                  |     |          |     |          |     | 2     |
| 92-AFB- 4066 | N             | 25 X 25       | 1                |     |          |     |          |     | 1     |
|              |               | 25 X 50       | 2                |     |          |     |          |     | 2     |
|              |               | 50 X 50       | 1                |     |          |     | 1        |     | 2     |
|              |               | 50 X 75       | 1                |     |          |     |          |     | 1     |
|              |               | 75 X 200      | 1                |     |          |     |          |     | 1     |
| 92-AFB- 4067 | N             |               |                  |     |          |     |          |     | 7     |
|              |               |               |                  |     |          |     |          |     |       |
| 92-AFB- 4067 | N             | 25 X 50       | 1                |     |          |     |          |     | 1     |
|              |               |               |                  |     |          |     |          |     | 1     |
| 92-AFB- 4068 | N             | 125 X 125     |                  |     | 1        |     |          |     | 1     |
|              |               |               |                  |     |          |     |          |     | 1     |
| 92-AFB- 4069 | N             | 25 X 50       | 1                |     |          |     |          |     | 1     |
|              |               | 25 X 75       | 1                |     |          |     |          |     | 1     |
|              |               |               |                  |     |          |     |          |     | 2     |
| 92-AFB- 4071 | N             | 25 X 25       | 2                |     |          |     |          |     | 2     |
|              |               | 25 X 50       | 1                |     |          |     |          |     | 1     |
|              |               | 50 X 50       | 1                |     |          |     |          |     | 1     |
|              |               | 50 X 75       |                  |     | 1        |     |          |     | 1     |
|              |               | 75 X 150      | 1                |     |          |     |          |     | 1     |
| 92-AFB- 4072 | N             |               |                  |     |          |     |          |     | 6     |
|              |               |               |                  |     |          |     |          |     |       |
|              |               |               |                  |     |          |     |          |     |       |
| 92-AFB- 4072 | N             | 25 X 50       | 2                |     |          |     |          |     | 2     |
|              |               | 50 X 50       |                  |     | 1        |     |          |     | 1     |
|              |               |               |                  |     |          |     |          |     | 3     |
| 92-AFB- 4073 | N             | 50 X 100      | 1                |     |          |     |          |     | 1     |
|              |               |               |                  |     |          |     |          |     | 1     |
| 92-AFB- 4074 | N             | 50 X 50       | 1                |     |          |     |          |     | 1     |
|              |               | 50 X 125      | 1                |     |          |     |          |     | 1     |
|              |               |               |                  |     |          |     |          |     | 2     |
| 92-AFB- 4075 | N             | 75 X 100      | 1                |     |          |     |          |     | 1     |
|              |               | 100 X 100     | 1                |     |          |     |          |     | 1     |
|              |               | 100 X 150     | 1                |     |          |     |          |     | 1     |
|              |               |               |                  |     |          |     |          |     | 3     |
| 92-AFB- 4076 | N             | 25 X 75       | 1                |     |          |     |          |     | 1     |
|              |               | 100 X 100     | 1                |     |          |     |          |     | 1     |
|              |               | 100 X 150     | 1                |     |          |     |          |     | 1     |
|              |               |               |                  |     |          |     |          |     | 3     |

| SAMPLE #     | PANNED<br>Y/N | DIAMETER (μm) | NUMBER OF GRAINS |     |          |     |          |     |       |
|--------------|---------------|---------------|------------------|-----|----------|-----|----------|-----|-------|
|              |               |               | RESHAPED         |     | MODIFIED |     | PRISTINE |     | TOTAL |
|              |               |               | Table            | Pan | Table    | Pan | Table    | Pan |       |
| 92-AFB- 4077 | N             | 75 X 125      | 1                |     |          |     |          |     | 1     |
|              |               | 225 X 225     | 1                |     |          |     |          |     | 1     |
|              |               |               |                  |     |          |     |          |     | 2     |
| 92-AFB- 4078 | N             | 50 X 100      | 1                |     |          |     |          |     | 1     |
|              |               |               |                  |     |          |     |          |     | 1     |
| 92-AFB- 4079 | N             | 50 X 100      | 1                |     |          |     |          |     | 1     |
|              |               |               |                  |     |          |     |          |     | 1     |
| 92-AFB- 4080 | N             | 50 X 75       | 1                |     |          |     |          |     | 1     |
|              |               | 75 X 75       | 1                |     |          |     |          |     | 1     |
|              |               |               |                  |     |          |     |          |     | 2     |
| 92-AFB- 4081 | N             | 50 X 75       | 1                |     |          |     |          |     | 1     |
|              |               | 150 X 300     | 1                |     |          |     |          |     | 1     |
|              |               |               |                  |     |          |     |          |     | 2     |
| 92-AFB- 4082 | N             | NO V.G.       |                  |     |          |     |          |     |       |
| 92-AFB- 4083 | N             | NO V.G.       |                  |     |          |     |          |     |       |
| 92-AFB- 4084 | N             | 50 X 100      | 1                |     |          |     |          |     | 1     |
|              |               |               |                  |     |          |     |          |     | 1     |
| 92-AFB- 4085 | N             | NO V.G.       |                  |     |          |     |          |     |       |
| 92-AFB- 4086 | N             | 50 X 75       | 1                |     |          |     |          |     | 1     |
|              |               |               |                  |     |          |     |          |     | 1     |
| 92-AFB- 4087 | N             | NO V.G.       |                  |     |          |     |          |     |       |
| 92-AFB- 4088 | N             | NO V.G.       |                  |     |          |     |          |     |       |
| 92-AFB- 4089 | N             | 25 X 50       |                  |     | 1        |     |          |     | 1     |
|              |               |               |                  |     |          |     |          |     | 1     |
| 92-AFB- 4090 | N             | 50 X 50       | 1                |     |          |     |          |     | 1     |
|              |               |               |                  |     |          |     |          |     | 1     |
| 92-AFB- 4091 | N             | 50 X 75       | 1                |     |          |     |          |     | 1     |
|              |               | 50 X 100      | 1                |     |          |     |          |     | 1     |
|              |               | 75 X 75       | 1                |     |          |     |          |     | 1     |
|              |               |               |                  |     |          |     |          |     | 3     |
| 92-AFB- 4092 | N             | NO V.G.       |                  |     |          |     |          |     |       |
| 92-AFB- 4093 | N             | 50 X 50       | 1                |     |          |     |          |     | 1     |
|              |               | 75 X 125      | 1                |     |          |     |          |     | 1     |
|              |               | 150 X 175     | 1                |     |          |     |          |     | 1     |
|              |               |               |                  |     |          |     |          |     | 3     |
| 92-AFB- 4094 | N             | NO V.G.       |                  |     |          |     |          |     |       |
| 92-AFB- 4095 | N             | NO V.G.       |                  |     |          |     |          |     |       |
| 92-AFB- 4096 | N             | 25 X 50       | 1                |     |          |     |          |     | 1     |
|              |               |               |                  |     |          |     |          |     | 1     |
| 92-AFB- 4097 | N             | NO V.G.       |                  |     |          |     |          |     |       |
| 92-AFB- 4098 | N             | 25 X 25       | 1                |     |          |     |          |     | 1     |
|              |               | 25 X 50       | 2                |     |          |     |          |     | 2     |
|              |               | 50 X 50       | 2                |     |          |     |          |     | 2     |
|              |               | 50 X 75       | 1                |     |          |     |          |     | 1     |
|              |               | 100 X 150     | 1                |     |          |     |          |     | 1     |
|              |               |               |                  |     |          |     |          |     | 7     |
| 92-AFB- 4099 | N             | 50 X 125      | 1                |     |          |     |          |     | 1     |
|              |               | 75 X 75       | 1                |     |          |     |          |     | 1     |
|              |               | 75 X 125      | 1                |     |          |     |          |     | 1     |
|              |               |               |                  |     |          |     |          |     | 3     |

| SAMPLE #     | PANNED<br>Y/N | DIAMETER (μm) | NUMBER OF GRAINS |     |          |     |          |     |       |
|--------------|---------------|---------------|------------------|-----|----------|-----|----------|-----|-------|
|              |               |               | RESHAPED         |     | MODIFIED |     | PRISTINE |     | TOTAL |
|              |               |               | Table            | Pan | Table    | Pan | Table    | Pan |       |
| 92-AFB- 4100 | N             | 25 X 50       | 3                |     |          |     |          |     | 3     |
|              |               | 75 X 100      | 1                |     |          |     |          |     | 1     |
|              |               | 100 X 100     | 1                |     |          |     |          |     | 1     |
|              |               |               |                  |     |          |     |          |     | 5     |
| 92-AFB- 4101 | N             | 25 X 50       |                  |     | 1        |     |          |     | 1     |
|              |               | 50 X 50       | 1                |     |          |     |          |     | 1     |
|              |               |               |                  |     |          |     |          |     | 2     |
| 92-AFB- 4102 | N             | 50 X 75       |                  |     | 1        |     |          |     | 1     |
|              |               |               |                  |     |          |     |          |     | 1     |
| 92-AFB- 4103 | N             | 25 X 50       | 3                |     |          |     | 1        |     | 4     |
|              |               | 25 X 125      | 1                |     |          |     |          |     | 1     |
|              |               | 50 X 150      | 1                |     |          |     |          |     | 1     |
|              |               | 75 X 75       | 1                |     |          |     |          |     | 1     |
|              |               | 100 X 150     | 1                |     |          |     |          |     | 1     |
|              |               |               |                  |     |          |     |          |     | 8     |
| 92-AFB- 4104 | N             | 25 X 50       | 1                |     |          |     |          |     | 1     |
|              |               | 50 X 100      | 1                |     |          |     |          |     | 1     |
|              |               | 50 X 125      | 1                |     |          |     |          |     | 1     |
|              |               | 75 X 225      | 1                |     |          |     |          |     | 1     |
|              |               | 150 X 200     | 1                |     |          |     |          |     | 1     |
|              |               |               |                  |     |          |     |          |     | 5     |
| 92-AFB- 4105 | N             | 25 X 25       | 2                |     |          |     |          |     | 2     |
|              |               | 25 X 50       | 1                |     |          |     |          |     | 1     |
|              |               | 50 X 50       | 1                |     |          |     |          |     | 1     |
|              |               | 50 X 75       | 2                |     |          |     |          |     | 2     |
|              |               |               |                  |     |          |     |          |     | 6     |
| 92-AFB- 4106 | N             | 25 X 50       | 1                |     |          |     |          |     | 1     |
|              |               | 50 X 50       | 1                |     |          |     |          |     | 1     |
|              |               |               |                  |     |          |     |          |     | 2     |
| 92-AFB- 4107 | N             | 25 X 25       | 1                |     |          |     |          |     | 1     |
|              |               | 25 X 50       | 2                |     |          |     |          |     | 2     |
|              |               | 25 X 75       | 1                |     |          |     |          |     | 1     |
|              |               |               |                  |     |          |     |          |     | 4     |
| 92-AFB- 4108 | N             | 25 X 50       | 1                |     |          |     |          |     | 1     |
|              |               | 50 X 75       | 1                |     |          |     |          |     | 1     |
|              |               | 75 X 100      | 1                |     |          |     |          |     | 1     |
|              |               |               |                  |     |          |     |          |     | 3     |
| 92-AFB- 4109 | N             | NO V.G.       |                  |     |          |     |          |     |       |
| 92-AFB- 4110 | N             | NO V.G.       |                  |     |          |     |          |     |       |
| 92-AFB- 4111 | N             | 75 X 100      | 1                |     |          |     |          |     | 1     |
|              |               |               |                  |     |          |     |          |     | 1     |
| 92-AFB- 4112 | N             | 25 X 50       | 1                |     |          |     |          |     | 1     |
|              |               | 50 X 75       | 1                |     |          |     |          |     | 1     |
|              |               |               |                  |     |          |     |          |     | 2     |
| 92-AFB- 4113 | N             | 25 X 25       | 2                |     |          |     |          |     | 2     |
|              |               | 25 X 50       | 2                |     |          |     |          |     | 2     |
|              |               | 25 X 100      | 1                |     |          |     |          |     | 1     |
|              |               | 50 X 75       | 1                |     |          |     |          |     | 1     |
|              |               | 100 X 175     | 1                |     |          |     |          |     | 1     |
|              |               |               |                  |     |          |     |          |     | 7     |
| 92-AFB- 4114 | N             | 75 X 125      | 1                |     |          |     |          |     | 1     |
|              |               | 100 X 175     | 1                |     |          |     |          |     | 1     |
|              |               |               |                  |     |          |     |          |     | 2     |

| SAMPLE #     | PANNED<br>Y/N | DIAMETER (μm) | NUMBER OF GRAINS |     |          |     |          |     |       |
|--------------|---------------|---------------|------------------|-----|----------|-----|----------|-----|-------|
|              |               |               | RESHAPED         |     | MODIFIED |     | PRISTINE |     | TOTAL |
|              |               |               | Table            | Pan | Table    | Pan | Table    | Pan |       |
| 92-AFB- 4115 | N             | 50 X 50       | 1                |     |          |     |          |     | 1     |
|              |               | 50 X 125      | 1                |     |          |     |          |     | 1     |
|              |               | 75 X 100      | 1                |     |          |     |          |     | 1     |
|              |               | 75 X 125      | 1                |     |          |     |          |     | 1     |
|              |               |               |                  |     |          |     |          |     | 4     |
| 92-AFB- 4116 | N             | 25 X 50       | 2                |     |          |     |          |     | 2     |
|              |               | 25 X 75       | 1                |     |          |     |          |     | 1     |
|              |               | 50 X 100      | 1                |     |          |     |          |     | 1     |
|              |               | 75 X 100      | 1                |     |          |     |          |     | 1     |
|              |               | 125 X 225     | 1                |     |          |     |          |     | 1     |
|              |               |               |                  |     |          |     |          |     | 6     |
| 92-AFB- 4117 | Y             | 15 X 15       |                  | 1   |          |     |          |     | 1     |
|              |               | 25 X 25       | 1                |     |          |     |          |     | 1     |
|              |               | 25 X 50       | 2                |     |          |     | 2        |     | 4     |
|              |               | 50 X 50       | 2                |     |          |     |          | 1   | 3     |
|              |               | 50 X 75       | 1                |     |          |     | 1        |     | 2     |
|              |               | 50 X 100      |                  |     |          |     | 1        |     | 1     |
|              |               |               |                  |     |          |     |          |     | 12    |
| 92-AFB- 4118 | N             | 50 X 75       | 1                |     |          |     |          |     | 1     |
|              |               |               |                  |     |          |     |          |     | 1     |
| 92-AFB- 4119 | N             | NO V.G.       |                  |     |          |     |          |     |       |
| 92-AFB- 4120 | N             | NO V.G.       |                  |     |          |     |          |     |       |
| 92-AFB- 4121 | N             | 25 X 25       | 2                |     |          |     | 1        |     | 3     |
|              |               | 25 X 50       | 1                |     |          |     |          |     | 1     |
|              |               | 75 X 125      | 1                |     |          |     |          |     | 1     |
|              |               |               |                  |     |          |     |          |     | 5     |
| 92-AFB- 4122 | N             | 25 X 50       | 1                |     | 1        |     |          |     | 2     |
|              |               | 50 X 50       | 2                |     |          |     |          |     | 2     |
|              |               | 50 X 75       | 3                |     |          |     |          |     | 3     |
|              |               | 75 X 100      | 1                |     |          |     |          |     | 1     |
|              |               |               |                  |     |          |     |          |     | 8     |
| 92-AFB- 4123 | N             | 15 X 25       | 1                |     |          |     |          |     | 1     |
|              |               | 15 X 50       |                  |     | 1        |     |          |     | 1     |
|              |               | 25 X 25       | 3                |     | 2        |     |          |     | 5     |
|              |               | 50 X 75       |                  |     | 1        |     |          |     | 1     |
|              |               | 75 X 125      | 1                |     |          |     |          |     | 1     |
|              |               |               |                  |     |          |     |          |     | 9     |
| 92-AFB- 4124 | N             | 15 X 15       | 1                |     |          |     |          |     | 1     |
|              |               | 25 X 25       |                  |     | 1        |     |          |     | 1     |
|              |               | 25 X 50       | 1                |     |          |     |          |     | 1     |
|              |               | 50 X 50       | 1                |     |          |     |          |     | 1     |
|              |               | 50 X 75       | 1                |     |          |     |          |     | 1     |
|              |               |               |                  |     |          |     |          |     | 5     |
| 92-AFB- 4125 | N             | 25 X 25       | 1                |     |          |     |          |     | 1     |
|              |               | 50 X 100      | 1                |     |          |     |          |     | 1     |
|              |               | 75 X 75       | 1                |     |          |     |          |     | 1     |
|              |               |               |                  |     |          |     |          |     | 3     |
| 92-AFB- 4126 | N             | 15 X 15       |                  |     | 1        |     |          |     | 1     |
|              |               | 25 X 25       | 1                |     | 2        |     |          |     | 3     |
|              |               |               |                  |     |          |     |          |     | 4     |
| 92-AFB- 4127 | N             | NO V.G.       |                  |     |          |     |          |     |       |
| 92-AFB- 4128 | N             | 25 X 25       | 3                |     | 1        |     |          |     | 4     |
|              |               | 50 X 75       | 1                |     |          |     |          |     | 1     |
|              |               |               |                  |     |          |     |          |     | 5     |

| SAMPLE #     | PANNED<br>Y/N | DIAMETER (µm) | NUMBER OF GRAINS |     |          |     |          |     |       |  |
|--------------|---------------|---------------|------------------|-----|----------|-----|----------|-----|-------|--|
|              |               |               | RESHAPED         |     | MODIFIED |     | PRISTINE |     | TOTAL |  |
|              |               |               | Table            | Pan | Table    | Pan | Table    | Pan |       |  |
| 92-AFB- 4129 | N             | 25 X 50       | 2                |     |          |     |          |     | 2     |  |
|              |               | 50 X 50       | 1                |     |          |     |          |     | 1     |  |
|              |               | 50 X 75       | 2                |     |          |     |          |     | 2     |  |
|              |               | 75 X 125      | 1                |     |          |     |          |     | 1     |  |
|              |               |               |                  |     |          |     |          |     | 6     |  |
| 92-AFB- 4130 | N             | 25 X 50       | 2                |     |          |     |          |     | 2     |  |
|              |               |               |                  |     |          |     |          |     | 2     |  |
| 92-AFB- 4131 | N             | 125 X 325     | 1                |     |          |     |          |     | 1     |  |
|              |               | 200 X 400     | 1                |     |          |     |          |     | 1     |  |
|              |               |               |                  |     |          |     |          |     | 2     |  |
| 92-AFB- 4132 | N             | NO V.G.       |                  |     |          |     |          |     |       |  |
| 92-AFB- 4133 | N             | 25 X 25       | 2                |     |          |     |          |     | 2     |  |
|              |               | 25 X 50       |                  |     | 1        |     |          |     | 1     |  |
|              |               | 50 X 50       | 1                |     |          |     |          |     | 1     |  |
|              |               | 50 X 100      | 1                |     |          |     |          |     | 1     |  |
|              |               |               |                  |     |          |     |          |     | 5     |  |
| 92-AFB- 4134 | N             | NO V.G.       |                  |     |          |     |          |     |       |  |
| 92-AFB- 4135 | N             | 50 X 100      | 1                |     |          |     |          |     | 1     |  |
|              |               |               |                  |     |          |     |          |     | 1     |  |
| 92-AFB- 4136 | N             | 25 X 25       | 1                |     |          |     |          |     | 1     |  |
|              |               | 25 X 75       | 1                |     |          |     |          |     | 1     |  |
|              |               | 50 X 75       | 1                |     |          |     |          |     | 1     |  |
|              |               |               |                  |     |          |     |          |     | 3     |  |
| 92-AFB- 4137 | N             | 50 X 75       | 2                |     |          |     |          |     | 2     |  |
| 92-AFB- 4138 | N             | 25 X 25       | 1                |     |          |     |          |     | 1     |  |
|              |               | 25 X 50       | 2                |     |          |     |          |     | 2     |  |
|              |               |               |                  |     |          |     |          |     | 3     |  |
| 92-AFB- 4139 | N             | 15 X 15       | 1                |     |          |     |          |     | 1     |  |
|              |               | 25 X 25       | 2                |     |          |     |          |     | 2     |  |
|              |               | 25 X 50       | 1                |     |          |     |          |     | 1     |  |
|              |               | 75 X 125      | 1                |     |          |     |          |     | 1     |  |
|              |               |               |                  |     |          |     |          |     | 5     |  |
| 92-AFB- 4140 | N             | 15 X 15       | 1                |     |          |     |          |     | 1     |  |
|              |               | 25 X 25       | 1                |     |          |     |          |     | 1     |  |
|              |               | 50 X 50       | 1                |     |          |     |          |     | 1     |  |
|              |               | 100 X 225     | 1                |     |          |     |          |     | 1     |  |
|              |               |               |                  |     |          |     |          |     | 4     |  |
| 92-AFB- 4141 | N             | 50 X 50       | 1                |     |          |     |          |     | 1     |  |
|              |               |               |                  |     |          |     |          |     | 1     |  |
| 92-AFB- 4142 | N             | NO V.G.       |                  |     |          |     |          |     |       |  |
| 92-AFB- 4143 | N             | NO V.G.       |                  |     |          |     |          |     |       |  |
| 92-AFB- 4144 | N             | 75 X 100      | 1                |     |          |     |          |     | 1     |  |
|              |               |               |                  |     |          |     |          |     | 1     |  |
| 92-AFB- 4145 | N             | 25 X 50       | 1                |     |          |     |          |     | 1     |  |
|              |               | 50 X 125      | 1                |     |          |     |          |     | 1     |  |
|              |               | 75 X 100      | 1                |     |          |     |          |     | 1     |  |
|              |               |               |                  |     |          |     |          |     | 3     |  |
| 92-AFB- 4146 | N             | 50 X 50       | 1                |     |          |     |          |     | 1     |  |
|              |               | 50 X 150      | 1                |     |          |     |          |     | 1     |  |
|              |               | 75 X 75       | 1                |     | 1        |     |          |     | 2     |  |
|              |               | 100 X 200     | 1                |     |          |     |          |     | 1     |  |
|              |               |               |                  |     |          |     |          |     | 5     |  |



| SAMPLE #     | PANNED<br>Y/N | DIAMETER (μm) | NUMBER OF GRAINS |     |          |     |          |     |       |  |
|--------------|---------------|---------------|------------------|-----|----------|-----|----------|-----|-------|--|
|              |               |               | RESHAPED         |     | MODIFIED |     | PRISTINE |     | TOTAL |  |
|              |               |               | Table            | Pan | Table    | Pan | Table    | Pan |       |  |
| 92-AFB- 4147 | N             | 50 X 50       | 1                |     |          |     |          |     | 1     |  |
|              |               | 50 X 75       | 1                |     |          |     |          |     | 1     |  |
|              |               | 125 X 125     | 1                |     |          |     |          |     | 1     |  |
|              |               |               |                  |     |          |     |          |     | 3     |  |
| 92-AFB- 4148 | N             | NO V.G.       |                  |     |          |     |          |     |       |  |
| 92-AFB- 4149 | N             | 15 X 15       | 1                |     |          |     |          |     | 1     |  |
|              |               | 25 X 25       | 2                |     |          |     |          |     | 2     |  |
|              |               | 25 X 50       | 1                |     |          |     |          |     | 1     |  |
|              |               | 50 X 50       | 1                |     |          |     |          |     | 1     |  |
|              |               | 50 X 100      | 1                |     |          |     |          |     | 1     |  |
|              |               | 75 X 75       | 1                |     |          |     |          |     | 1     |  |
|              |               | 100 X 125     | 1                |     |          |     |          |     | 1     |  |
|              |               |               |                  |     |          |     |          | 8   |       |  |
| 92-AFB- 4150 | N             | 25 X 50       | 1                |     |          |     |          |     | 1     |  |
|              |               |               |                  |     |          |     |          |     | 1     |  |
| 92-AFB- 4151 | N             | 25 X 25       |                  |     |          |     | 1        |     | 1     |  |
|              |               | 25 X 50       | 1                |     |          |     |          |     | 1     |  |
|              |               | 75 X 125      | 1                |     |          |     |          |     | 1     |  |
|              |               |               |                  |     |          |     |          |     | 3     |  |
| 92-AFB- 4152 | N             | NO V.G.       |                  |     |          |     |          |     |       |  |
| 92-AFB- 4153 | N             | 50 X 50       | 1                |     |          |     |          |     | 1     |  |
|              |               | 50 X 75       | 1                |     |          |     |          |     | 1     |  |
|              |               |               |                  |     |          |     |          |     | 2     |  |
| 92-AFB- 4154 | N             | 50 X 50       | 1                |     |          |     |          |     | 1     |  |
|              |               | 50 X 75       | 1                |     |          |     |          |     | 1     |  |
|              |               |               |                  |     |          |     |          |     | 2     |  |
| 92-AFB- 4155 | N             | 25 X 25       |                  |     |          |     | 1        |     | 1     |  |
|              |               | 50 X 50       | 1                |     |          |     |          |     | 1     |  |
|              |               | 550 X 750     | 1                |     |          |     |          |     | 1     |  |
|              |               |               |                  |     |          |     |          |     | 3     |  |
| 92-AFB- 4156 | N             | NO V.G.       |                  |     |          |     |          |     |       |  |
| 92-AFB- 4157 | N             | NO V.G.       |                  |     |          |     |          |     |       |  |
| 92-AFB- 4158 | N             | 25 X 25       | 1                |     |          |     |          |     | 1     |  |
|              |               | 25 X 100      | 1                |     |          |     |          |     | 1     |  |
|              |               | 75 X 75       | 2                |     |          |     |          |     | 2     |  |
|              |               |               |                  |     |          |     |          |     | 4     |  |
| 92-AFB- 4159 | Y             | 15 X 15       |                  |     | 3        | 2   |          |     | 5     |  |
|              |               | 25 X 25       | 8                | 1   | 2        | 1   |          |     | 12    |  |
|              |               | 25 X 50       | 11               |     | 1        | 1   |          |     | 13    |  |
|              |               | 25 X 75       | 2                |     |          |     |          |     | 2     |  |
|              |               | 50 X 50       | 1                |     |          |     |          | 1   | 2     |  |
|              |               | 50 X 75       | 1                | 1   |          |     | 1        |     | 3     |  |
|              |               | 50 X 100      | 1                | 1   |          |     |          |     | 2     |  |
|              |               | 75 X 100      | 1                |     |          |     |          |     | 1     |  |
|              |               | 125 X 175     | 1                |     |          |     |          |     | 1     |  |
|              |               | 250 X 450     | 1                |     |          |     |          |     | 1     |  |
|              |               |               |                  |     |          |     |          |     | 42    |  |
| 92-AFB- 4160 | N             | 15 X 15       | 1                |     |          |     |          |     | 1     |  |
|              |               | 25 X 25       | 1                |     | 1        |     |          |     | 2     |  |
|              |               | 25 X 50       | 1                |     |          |     |          |     | 1     |  |
|              |               | 50 X 75       | 1                |     |          |     |          |     | 1     |  |
|              |               | 75 X 100      | 1                |     |          |     |          |     | 1     |  |
|              |               | 100 X 100     | 1                |     |          |     |          |     | 1     |  |
|              |               |               |                  |     |          |     | 7        |     |       |  |

| SAMPLE #     | PANNED<br>Y/N | DIAMETER (µm) | NUMBER OF GRAINS |     |          |     |          |     |       |    |
|--------------|---------------|---------------|------------------|-----|----------|-----|----------|-----|-------|----|
|              |               |               | RESHAPED         |     | MODIFIED |     | PRISTINE |     | TOTAL |    |
|              |               |               | Table            | Pan | Table    | Pan | Table    | Pan |       |    |
| 92-AFB- 4161 | Y             | 15 X 15       | 2                | 1   | 1        |     |          |     |       | 4  |
|              |               | 25 X 25       | 3                | 1   | 1        |     |          |     |       | 5  |
|              |               | 25 X 50       | 3                | 1   |          |     | 1        |     |       | 5  |
|              |               | 50 X 50       | 1                | 1   |          |     |          |     |       | 2  |
|              |               |               |                  |     |          |     |          |     |       | 16 |
| 92-AFB- 4162 | Y             | 15 X 15       | 2                |     |          |     | 1        |     |       | 3  |
|              |               | 25 X 25       | 2                |     |          |     | 1        |     |       | 3  |
|              |               | 25 X 50       | 1                |     |          |     |          |     |       | 1  |
|              |               | 50 X 75       | 1                |     |          |     |          |     |       | 1  |
|              |               | 75 X 75       | 1                |     |          |     |          |     |       | 1  |
|              |               | 75 X 125      |                  | 1   |          |     |          |     |       | 1  |
|              |               |               |                  |     |          |     |          |     |       | 10 |
| 92-AFB- 4163 | N             | 50 X 75       | 1                |     |          |     |          |     |       | 1  |
|              |               |               |                  |     |          |     |          |     |       | 1  |
| 92-AFB- 4164 | N             | 25 X 25       | 1                |     |          |     |          |     |       | 1  |
|              |               | 25 X 75       | 1                |     |          |     |          |     |       | 1  |
|              |               | 25 X 150      | 1                |     |          |     |          |     |       | 1  |
|              |               | 50 X 75       | 1                |     |          |     |          |     |       | 1  |
|              |               | 50 X 100      | 1                |     |          |     |          |     |       | 1  |
|              |               | 75 X 125      | 1                |     |          |     |          |     |       | 1  |
|              |               |               |                  |     |          |     |          |     |       | 6  |
| 92-AFB- 4165 | N             | 25 X 50       |                  |     |          |     | 1        |     |       | 1  |
|              |               |               |                  |     |          |     |          |     |       | 1  |
| 92-AFB- 4166 | Y             | 25 X 25       |                  | 3   |          |     | 1        | 1   |       | 5  |
|              |               | 25 X 50       | 1                |     | 2        |     | 2        |     |       | 5  |
|              |               | 50 X 50       | 1                |     |          |     |          |     |       | 1  |
|              |               | 50 X 75       | 3                |     |          |     |          |     |       | 3  |
|              |               | 50 X 100      |                  |     | 1        |     |          |     |       | 1  |
|              |               | 75 X 75       |                  |     | 1        |     | 1        |     |       | 2  |
|              |               | 100 X 125     |                  |     |          |     | 1        |     |       | 1  |
|              |               | 100 X 125     | 1                |     |          |     |          |     |       | 1  |
|              |               |               |                  |     |          |     |          |     |       | 19 |
| 92-AFB- 4167 | N             | 25 X 25       | 1                |     |          |     | 2        |     |       | 3  |
|              |               | 25 X 50       | 1                |     |          |     | 2        |     |       | 3  |
|              |               |               |                  |     |          |     |          |     |       | 6  |
| 92-AFB- 4168 | N             | 25 X 75       | 1                |     |          |     |          |     |       | 1  |
|              |               | 50 X 50       | 1                |     |          |     |          |     |       | 1  |
|              |               | 50 X 125      | 1                |     |          |     |          |     |       | 1  |
|              |               | 50 X 175      | 1                |     |          |     |          |     |       | 1  |
|              |               | 75 X 100      | 1                |     |          |     |          |     |       | 1  |
| 92-AFB- 4169 | Y             |               |                  |     |          |     |          |     |       | 5  |
|              |               | 15 X 15       | 1                |     |          |     |          |     |       | 1  |
|              |               | 25 X 25       | 1                | 1   |          |     | 1        |     |       | 3  |
|              |               | 25 X 50       | 3                | 1   |          |     |          |     |       | 4  |
|              |               | 25 X 75       | 1                |     |          |     |          |     |       | 1  |
|              |               | 50 X 75       | 2                |     |          |     |          |     |       | 2  |
|              |               | 75 X 75       | 1                |     |          |     |          |     |       | 1  |
| 92-AFB- 4170 | N             |               |                  |     |          |     |          |     |       | 12 |
|              |               | 25 X 25       | 1                |     | 1        |     |          |     |       | 2  |
|              |               | 25 X 50       | 2                |     |          |     |          |     |       | 2  |
|              |               | 50 X 50       | 1                |     |          |     |          |     |       | 1  |
|              |               | 50 X 50       |                  |     |          |     | 1        |     |       | 1  |
|              |               | 50 X 75       | 1                |     |          |     |          |     |       | 1  |
|              |               | 75 X 75       | 1                |     |          |     |          |     |       | 1  |
| 92-AFB- 4170 | N             | 75 X 100      | 1                |     |          |     |          |     |       | 1  |
|              |               |               |                  |     |          |     |          |     |       | 9  |

| SAMPLE #     | PANNED<br>Y/N | DIAMETER (μm) | NUMBER OF GRAINS |     |          |     |          |     |       |
|--------------|---------------|---------------|------------------|-----|----------|-----|----------|-----|-------|
|              |               |               | RESHAPED         |     | MODIFIED |     | PRISTINE |     | TOTAL |
|              |               |               | Table            | Pan | Table    | Pan | Table    | Pan |       |
| 92-AFB- 4171 | Y             | 15 X 15       | 2                |     |          |     |          |     | 2     |
|              |               | 25 X 25       | 2                |     |          |     |          |     | 2     |
|              |               | 25 X 50       | 1                |     |          |     |          |     | 1     |
|              |               | 50 X 50       | 1                |     |          |     |          |     | 1     |
|              |               | 50 X 75       | 1                | 1   |          |     |          |     | 2     |
|              |               | 50 X 100      | 1                |     |          |     |          |     | 1     |
|              |               | 75 X 100      | 1                |     |          |     |          |     | 1     |
|              |               | 100 X 175     | 1                |     |          |     |          |     | 1     |
|              |               |               |                  |     |          |     |          |     | 11    |
| 92-AFB- 4172 | N             | 25 X 25       | 2                |     |          |     |          |     | 2     |
|              |               | 25 X 50       | 1                |     |          |     |          |     | 1     |
|              |               | 25 X 125      | 1                |     |          |     |          |     | 1     |
|              |               | 75 X 175      | 1                |     |          |     |          |     | 1     |
|              |               | 100 X 125     | 1                |     |          |     | 1        |     | 2     |
|              |               | 200 X 400     | 1                |     |          |     |          |     | 1     |
|              |               |               |                  |     |          |     |          |     | 8     |
| 92-AFB- 4173 | N             | 25 X 50       | 1                |     | 1        |     |          |     | 2     |
|              |               | 25 X 75       | 1                |     |          |     |          |     | 1     |
|              |               | 50 X 50       | 1                |     |          |     |          |     | 1     |
|              |               | 50 X 75       | 1                |     |          |     |          |     | 1     |
|              |               | 75 X 75       | 1                |     |          |     |          |     | 1     |
|              |               |               |                  |     |          |     |          |     | 6     |
| 92-AFB- 4174 | N             | 15 X 15       |                  |     | 1        |     |          |     | 1     |
|              |               | 25 X 25       | 2                |     |          |     | 1        |     | 3     |
|              |               | 25 X 50       | 2                |     |          |     |          |     | 2     |
|              |               | 75 X 100      |                  |     | 1        |     |          |     | 1     |
|              |               |               |                  |     |          |     |          |     | 7     |
| 92-AFB- 4175 | N             | 25 X 50       | 1                |     |          |     | 1        |     | 2     |
|              |               | 50 X 50       | 1                |     |          |     |          |     | 1     |
|              |               | 50 X 75       | 1                |     |          |     |          |     | 1     |
|              |               | 125 X 150     | 1                |     |          |     |          |     | 1     |
|              |               |               |                  |     |          |     |          |     | 5     |
| 92-AFB- 4176 | N             | 25 X 50       | 1                |     |          |     |          |     | 1     |
|              |               | 100 X 125     | 1                |     |          |     |          |     | 1     |
|              |               |               |                  |     |          |     |          |     | 2     |
| 92-AFB- 4177 | Y             | 15 X 15       |                  |     | 2        |     | 1        |     | 3     |
|              |               | 25 X 25       | 2                |     |          |     | 1        |     | 3     |
|              |               | 25 X 50       |                  | 1   |          |     | 1        |     | 2     |
|              |               | 25 X 175      | 1                |     |          |     |          |     | 1     |
|              |               | 75 X 100      | 1                | 1   |          |     |          |     | 2     |
|              |               | 100 X 100     |                  | 1   |          |     |          |     | 1     |
|              |               | 100 X 125     | 2                |     |          |     |          |     | 2     |
|              |               | 175 X 225     | 1                |     |          |     |          |     | 1     |
|              |               | 300 X 375     | 1                |     |          |     |          |     | 1     |
|              |               |               |                  |     |          |     |          |     | 16    |
| 92-AFB- 4178 | Y             | 25 X 25       | 3                |     |          |     |          |     | 3     |
|              |               | 25 X 50       | 3                | 1   |          |     | 2        |     | 6     |
|              |               | 50 X 50       |                  |     | 1        |     |          |     | 1     |
|              |               | 50 X 75       | 2                |     |          |     | 1        |     | 3     |
|              |               | 75 X 75       | 2                |     | 2        |     |          |     | 4     |
|              |               | 75 X 100      |                  | 1   |          |     |          |     | 1     |
|              |               | 150 X 200     | 1                |     |          |     |          |     | 1     |
|              |               |               |                  |     |          |     |          |     | 19    |
| 92-AFB- 4179 | N             | 25 X 25       | 2                |     |          |     |          |     | 2     |
|              |               | 25 X 50       | 1                |     |          |     |          |     | 1     |
|              |               | 50 X 75       | 1                |     |          |     |          |     | 1     |
|              |               |               |                  |     |          |     |          |     | 4     |
| 92-AFB- 4180 | N             | 25 X 25       |                  |     |          | 1   |          |     | 1     |
|              |               | 25 X 75       |                  |     |          |     | 1        |     | 1     |
|              |               |               |                  |     |          |     |          |     | 2     |

| SAMPLE #     | PANNED<br>Y/N | DIAMETER (µm) | NUMBER OF GRAINS |     |          |     |          |     | TOTAL |
|--------------|---------------|---------------|------------------|-----|----------|-----|----------|-----|-------|
|              |               |               | RESHAPED         |     | MODIFIED |     | PRISTINE |     |       |
|              |               |               | Tabl             | Pan | Table    | Pan | Table    | Pan |       |
| 92-AFB- 4181 | Y             | 15 X 15       |                  |     |          |     | 2        | 1   | 3     |
|              |               | 25 X 25       |                  | 1   | 2        | 1   |          | 1   | 5     |
|              |               | 25 X 50       | 1                | 2   | 1        | 1   |          | 1   | 6     |
|              |               | 50 X 50       | 3                | 3   |          | 1   |          |     | 7     |
|              |               | 50 X 75       |                  |     |          |     | 1        |     | 1     |
|              |               | 50 X 100      | 1                |     |          |     |          |     | 1     |
|              |               | 75 X 75       | 1                |     |          |     |          |     | 1     |
|              |               | 75 X 125      | 1                |     |          |     |          |     | 1     |
|              |               | 125 X 150     | 1                |     |          |     |          |     | 1     |
|              |               | 250 X 400     | 1                |     |          |     |          |     | 1     |
|              |               |               |                  |     |          |     |          | 27  |       |
| 92-AFB- 4182 | Y             | 15 X 15       |                  |     |          | 1   | 8        | 2   | 11    |
|              |               | 15 X 25       |                  |     | 1        |     | 1        | 1   | 3     |
|              |               | 25 X 25       |                  |     | 4        |     | 12       | 2   | 18    |
|              |               | 25 X 50       |                  |     | 3        | 1   | 5        | 1   | 10    |
|              |               | 25 X 75       |                  |     | 1        |     | 1        |     | 2     |
|              |               | 50 X 50       |                  |     | 4        |     | 2        | 1   | 7     |
|              |               | 50 X 75       | 2                |     |          | 1   |          | 1   | 4     |
|              |               | 50 X 100      | 1                |     |          |     |          | 1   | 2     |
|              |               | 75 X 75       |                  |     | 2        |     |          |     | 2     |
|              |               | 75 X 100      | 1                |     | 1        |     |          |     | 2     |
| 100 X 125    | 1             |               | 1                |     | 1        |     | 3        |     |       |
|              |               |               |                  |     |          |     |          | 64  |       |
| 92-AFB- 4183 | Y             | 15 X 15       |                  |     |          |     | 3        | 1   | 4     |
|              |               | 25 X 25       |                  |     | 6        |     | 8        | 1   | 15    |
|              |               | 25 X 50       | 2                |     | 3        |     |          |     | 5     |
|              |               | 25 X 75       |                  |     | 1        |     |          |     | 1     |
|              |               | 50 X 50       | 3                | 1   | 2        | 2   |          |     | 8     |
|              |               | 50 X 75       |                  |     | 1        | 1   |          |     | 2     |
|              |               | 75 X 75       |                  |     |          | 1   |          |     | 1     |
|              |               | 75 X 125      |                  |     | 1        |     |          |     | 1     |
| 100 X 150    |               |               | 1                |     |          |     | 1        |     |       |
|              |               |               |                  |     |          |     |          | 38  |       |
| 92-AFB- 4184 | Y             | 15 X 15       | 1                |     |          |     | 1        |     | 2     |
|              |               | 25 X 25       | 3                |     | 2        | 1   |          |     | 6     |
|              |               | 25 X 50       | 1                | 1   | 1        |     |          | 1   | 4     |
|              |               | 50 X 50       | 1                | 1   |          |     |          |     | 2     |
|              |               | 50 X 125      | 1                |     |          |     |          |     | 1     |
|              |               |               |                  |     |          |     |          | 15  |       |
| 92-AFB- 4185 | Y             | 15 X 15       |                  |     |          |     |          | 1   | 1     |
|              |               | 15 X 25       |                  |     |          |     | 1        |     | 1     |
|              |               | 25 X 25       |                  | 1   |          |     | 2        | 1   | 4     |
|              |               | 25 X 50       |                  |     | 1        | 1   |          | 1   | 3     |
|              |               | 25 X 75       |                  |     |          | 1   |          | 1   | 2     |
|              |               | 50 X 50       |                  | 1   |          |     |          | 1   | 2     |
|              |               | 50 X 75       | 1                |     |          |     |          |     | 1     |
|              |               | 50 X 100      | 1                |     | 2        |     |          |     | 3     |
| 50 X 125     | 1             |               |                  |     |          |     | 1        |     |       |
|              |               |               |                  |     |          |     |          | 18  |       |
| 92-AFB- 4186 | Y             | 25 X 25       |                  |     | 4        | 1   | 1        | 2   | 8     |
|              |               | 25 X 50       | 2                |     | 2        |     |          |     | 4     |
|              |               | 25 X 75       |                  |     |          |     | 1        |     | 1     |
|              |               | 50 X 50       | 2                | 1   | 1        |     |          |     | 4     |
|              |               | 50 X 75       | 1                | 1   |          | 1   |          |     | 3     |
|              |               | 50 X 100      | 1                | 1   |          |     |          |     | 2     |
|              |               |               |                  |     |          |     |          | 22  |       |
| 92-AFB- 4187 | Y             | 15 X 15       |                  |     |          |     | 1        | 1   | 2     |
|              |               | 25 X 25       |                  |     |          | 2   | 1        | 3   | 6     |
|              |               | 25 X 50       |                  |     |          |     | 1        |     | 1     |
|              |               | 50 X 75       |                  |     |          | 1   |          | 2   | 3     |
|              |               |               |                  |     |          |     |          | 12  |       |

| SAMPLE #     | PANNED<br>Y/N | DIAMETER (μm) | NUMBER OF GRAINS |         |          |     |          |     |       |   |    |
|--------------|---------------|---------------|------------------|---------|----------|-----|----------|-----|-------|---|----|
|              |               |               | RESHAPED         |         | MODIFIED |     | PRISTINE |     | TOTAL |   |    |
|              |               |               | Table            | Pan     | Table    | Pan | Table    | Pan |       |   |    |
| 92-AFB- 4188 | Y             | 15 X 15       | 1                | 2       |          |     |          | 1   | 4     |   |    |
|              |               | 25 X 25       |                  | 2       |          |     |          | 1   | 3     |   |    |
|              |               | 25 X 50       | 2                |         |          |     | 1        |     | 3     |   |    |
|              |               | 25 X 75       |                  | 1       |          |     |          |     | 1     |   |    |
|              |               | 50 X 50       |                  | 1       |          |     |          |     | 1     |   |    |
|              |               | 50 X 75       | 3                | 1       |          |     |          |     | 4     |   |    |
|              |               | 50 X 100      |                  |         |          |     |          | 1   | 1     |   |    |
|              |               | 75 X 100      |                  |         |          |     | 1        |     | 1     |   |    |
|              |               | 75 X 125      | 1                |         |          |     |          |     | 1     |   |    |
|              |               | 150 X 250     | 1                |         |          |     |          |     | 1     |   |    |
|              |               |               |                  |         |          |     |          | 20  |       |   |    |
| 92-AFB- 4189 | N             | 25 X 25       |                  |         |          |     | 1        |     | 1     |   |    |
|              |               | 25 X 50       |                  |         |          |     |          | 1   | 1     |   |    |
|              |               | 25 X 75       | 1                |         |          |     |          |     | 1     |   |    |
|              |               | 50 X 125      | 1                |         |          |     |          |     | 1     |   |    |
|              |               | 50 X 175      |                  | 1       |          |     |          |     | 1     |   |    |
|              |               | 75 X 75       | 1                |         |          |     |          |     | 1     |   |    |
|              |               |               |                  |         |          |     |          |     | 6     |   |    |
| 92-AFB- 4190 | N             | 50 X 100      |                  |         |          |     | 1        |     | 1     |   |    |
|              |               | 75 X 100      | 1                |         |          |     |          |     | 1     |   |    |
|              |               | 100 X 125     | 1                |         |          |     |          |     | 1     |   |    |
|              |               |               |                  |         |          |     |          |     | 3     |   |    |
| 92-AFB- 4191 | Y             | 25 X 25       | 2                | 1       |          |     | 2        |     | 5     |   |    |
|              |               | 50 X 75       | 2                |         |          |     |          |     | 2     |   |    |
|              |               | 75 X 100      | 1                |         |          |     |          |     | 1     |   |    |
|              |               | 75 X 150      | 1                |         |          |     |          |     | 1     |   |    |
|              |               | 100 X 150     | 1                |         |          |     |          |     | 1     |   |    |
|              |               | 100 X 175     |                  |         |          | 1   |          |     | 1     |   |    |
|              |               |               |                  |         |          |     |          |     | 11    |   |    |
| 92-AFB- 4192 | N             | 25 X 50       |                  |         |          |     | 1        |     | 1     |   |    |
|              |               | 50 X 50       | 1                |         |          |     |          |     | 1     |   |    |
|              |               | 50 X 75       | 1                |         |          |     |          |     | 1     |   |    |
|              |               | 50 X 100      | 1                |         |          |     |          |     | 1     |   |    |
|              |               |               |                  |         |          |     |          |     | 4     |   |    |
| 92-AFB- 4193 | N             | 25 X 25       | 2                |         |          |     | 1        |     | 3     |   |    |
|              |               | 25 X 50       |                  |         |          |     | 1        |     | 1     |   |    |
|              |               | 50 X 50       | 1                |         |          |     |          |     | 1     |   |    |
|              |               |               |                  |         |          |     |          |     | 5     |   |    |
| 92-AFB- 4194 | Y             | 15 X 15       |                  |         |          |     | 4        | 5   | 9     |   |    |
|              |               | 25 X 25       |                  |         |          |     | 8        | 6   | 14    |   |    |
|              |               | 25 X 50       | 3                |         | 1        |     | 17       | 5   | 26    |   |    |
|              |               | 25 X 75       |                  |         | 2        |     | 5        | 1   | 8     |   |    |
|              |               | 25 X 100      |                  |         |          |     | 1        | 1   | 2     |   |    |
|              |               | 50 X 50       |                  |         |          |     | 5        | 4   | 9     |   |    |
|              |               | 50 X 75       |                  |         |          |     | 6        | 2   | 8     |   |    |
|              |               | 50 X 100      |                  |         | 1        |     | 1        | 2   | 4     |   |    |
|              |               | 50 X 125      |                  | 1       |          |     |          |     | 1     |   |    |
|              |               | 50 X 150      |                  |         |          |     |          |     | 0     |   |    |
|              |               | 50 X 200      |                  |         |          |     | 1        |     | 1     |   |    |
|              |               | 75 X 75       | 1                |         |          |     | 3        |     | 4     |   |    |
|              |               | 75 X 100      | 1                | 1       |          |     |          |     | 2     |   |    |
|              |               | 75 X 125      | 1                |         |          |     |          |     | 1     |   |    |
|              |               | 100 X 125     | 1                |         |          | 2   |          | 1   | 4     |   |    |
|              |               |               |                  |         |          |     |          |     | 93    |   |    |
|              |               |               |                  |         |          |     |          |     |       |   |    |
|              |               | 92-AFB- 4195  | Y                | 15 X 15 |          |     | 1        |     | 1     |   | 2  |
|              |               |               |                  | 25 X 25 |          |     | 2        | 1   | 5     | 2 | 10 |
| 25 X 50      |               |               |                  |         | 2        | 1   | 1        |     | 4     |   |    |
| 50 X 50      |               |               |                  |         | 3        |     | 3        |     | 6     |   |    |
| 50 X 75      | 1             |               |                  | 2       | 3        |     |          |     | 6     |   |    |
| 75 X 75      |               |               |                  |         |          |     | 1        |     | 1     |   |    |
| 75 X 75      |               |               |                  |         |          | 1   |          |     | 1     |   |    |
|              |               |               |                  |         |          |     |          |     | 30    |   |    |



| SAMPLE #     | PANNED<br>Y/N | DIAMETER (μm) | NUMBER OF GRAINS |     |          |     |          |     |       |    |
|--------------|---------------|---------------|------------------|-----|----------|-----|----------|-----|-------|----|
|              |               |               | RESHAPED         |     | MODIFIED |     | PRISTINE |     | TOTAL |    |
|              |               |               | Table            | Pan | Table    | Pan | Table    | Pan |       |    |
| 92-AFB- 4196 | Y             | 25 X 25       | 1                | 3   |          |     |          |     |       | 4  |
|              |               | 25 X 50       |                  | 1   |          | 1   | 1        |     | 3     |    |
|              |               | 25 X 75       |                  | 1   |          |     |          |     | 1     |    |
|              |               | 50 X 75       | 2                |     |          |     |          |     | 2     |    |
|              |               | 50 X 100      |                  |     |          |     | 1        |     | 1     |    |
|              |               | 50 X 125      |                  | 1   |          |     |          |     | 1     |    |
|              |               | 75 X 75       | 1                |     |          |     |          |     | 1     |    |
|              |               | 100 X 100     | 1                |     |          |     |          |     | 1     |    |
|              |               | 100 X 150     | 1                |     |          |     |          |     | 1     |    |
|              |               | 100 X 200     | 1                |     |          |     |          |     | 1     |    |
|              |               | 100 X 250     | 1                |     |          |     |          |     | 1     |    |
|              |               |               |                  |     |          |     |          |     | 17    |    |
| 92-AFB- 4197 | Y             | 15 X 15       | 1                | 1   |          |     |          | 2   |       | 4  |
|              |               | 25 X 25       | 2                | 1   |          |     | 2        | 2   |       | 7  |
|              |               | 25 X 50       | 1                |     |          |     | 1        | 1   |       | 3  |
|              |               | 25 X 75       |                  |     |          |     | 1        | 1   |       | 2  |
|              |               | 50 X 75       | 2                |     |          |     |          |     |       | 2  |
|              |               | 50 X 125      |                  |     |          |     | 1        |     |       | 1  |
|              |               | 75 X 100      | 1                |     |          |     |          |     |       | 1  |
|              |               | 125 X 175     | 1                |     |          |     |          |     |       | 1  |
|              |               | 225 X 125     |                  |     |          |     | 1        |     |       | 1  |
|              |               |               |                  |     |          |     |          |     |       | 22 |
| 92-AFB- 4198 | N             | 25 X 25       | 3                |     |          |     |          |     |       | 3  |
|              |               | 25 X 50       | 1                |     |          |     |          |     |       | 1  |
|              |               | 50 X 75       | 2                |     |          |     |          |     |       | 2  |
|              |               |               |                  |     |          |     |          |     |       | 6  |
| 92-AFB- 4199 | N             | 25 X 75       | 1                |     |          |     |          |     |       | 1  |
|              |               | 125 X 175     | 1                |     |          |     |          |     |       | 1  |
|              |               |               |                  |     |          |     |          |     |       | 2  |
| 92-AFB- 4200 | N             | 15 X 15       | 1                |     |          |     |          |     |       | 1  |
|              |               | 25 X 25       | 1                |     |          |     |          |     |       | 1  |
|              |               | 25 X 50       | 1                |     |          |     |          |     |       | 1  |
|              |               | 50 X 75       |                  |     | 1        |     |          |     |       | 1  |
|              |               | 75 X 150      | 2                |     |          |     |          |     |       | 2  |
|              |               | 100 X 125     | 1                |     |          |     |          |     |       | 1  |
|              |               | 225 X 225     | 1                |     |          |     |          |     |       | 1  |
|              |               |               |                  |     |          |     |          |     |       | 8  |
| 92-AFB- 4201 | N             | 50 X 50       | 1                |     |          |     |          |     |       | 1  |
|              |               | 75 X 100      | 1                |     |          |     |          |     |       | 1  |
|              |               |               |                  |     |          |     |          |     |       | 2  |
| 92-AFB- 4202 | N             | 200 X 375     | 1                |     |          |     |          |     |       | 1  |
|              |               |               |                  |     |          |     |          |     |       | 1  |
| 92-AFB- 4203 | N             | NO V.G.       |                  |     |          |     |          |     |       |    |
| 92-AFB- 4204 | N             | 75 X 100      | 1                |     |          |     |          |     |       | 1  |
|              |               |               |                  |     |          |     |          |     |       | 1  |
| 92-AFB- 4205 | N             | 75 X 125      | 1                |     |          |     |          |     |       | 1  |
|              |               |               |                  |     |          |     |          |     |       | 1  |
| 92-AFB- 4206 | N             | 25 X 100      | 1                |     |          |     |          |     |       | 1  |
|              |               |               |                  |     |          |     |          |     |       | 1  |
| 92-AFB- 4207 | N             | 25 X 25       | 2                |     |          |     |          |     |       | 2  |
|              |               | 50 X 75       | 1                |     |          |     |          |     |       | 1  |
|              |               | 75 X 150      | 1                |     |          |     |          |     |       | 1  |
|              |               |               |                  |     |          |     |          |     |       | 4  |
| 92-AFB- 4208 | N             | 100 X 150     | 1                |     |          |     |          |     |       | 1  |
|              |               |               |                  |     |          |     |          |     |       | 1  |
| 92-AFB- 4209 | N             | NO V.G.       |                  |     |          |     |          |     |       |    |

| SAMPLE #     | PANNED<br>Y/N | DIAMETER (μm) | NUMBER OF GRAINS |     |          |     |          |     |       |
|--------------|---------------|---------------|------------------|-----|----------|-----|----------|-----|-------|
|              |               |               | RESHAPED         |     | MODIFIED |     | PRISTINE |     | TOTAL |
|              |               |               | Table            | Pan | Table    | Pan | Table    | Pan |       |
| 92-AFB- 4211 | N             | 75 X 75       | 1                |     |          |     |          |     | 1     |
|              |               |               |                  |     |          |     |          |     | 1     |
| 92-AFB- 4212 | N             | 25 X 25       |                  |     | 1        |     | 1        |     | 2     |
|              |               | 25 X 50       |                  |     |          |     | 1        |     | 1     |
|              |               | 50 X 50       |                  |     | 1        |     | 1        |     | 2     |
|              |               |               |                  |     |          |     |          |     | 5     |
| 92-AFB- 4216 | N             | 25 X 50       | 1                |     |          |     |          |     | 1     |
|              |               | 50 X 50       | 1                |     |          |     |          |     | 1     |
|              |               |               |                  |     |          |     |          |     | 2     |
| 92-AFB- 4217 | N             | 25 X 25       | 1                |     |          |     |          |     | 1     |
|              |               | 50 X 50       | 1                |     |          |     |          |     | 1     |
|              |               |               |                  |     |          |     |          |     | 2     |
| 92-AFB- 4218 | N             | 25 X 50       | 1                |     |          |     |          |     | 1     |
|              |               |               |                  |     |          |     |          |     | 1     |
| 92-AFB- 4219 | N             | 25 X 25       | 1                |     |          |     |          |     | 1     |
|              |               | 25 X 50       | 1                |     |          |     |          |     | 1     |
|              |               |               |                  |     |          |     |          |     | 2     |
| 92-AFB- 4220 | N             | 25 X 25       |                  |     |          |     | 2        |     | 2     |
|              |               | 25 X 50       | 1                |     |          |     | 2        |     | 3     |
|              |               | 50 X 100      | 1                |     |          |     |          |     | 1     |
|              |               |               |                  |     |          |     |          |     | 6     |
| 92-AFB- 4224 | N             | 25 X 25       | 1                |     |          |     |          |     | 1     |
|              |               | 50 X 50       |                  |     |          |     | 1        |     | 1     |
|              |               | 50 X 100      | 1                |     |          |     |          |     | 1     |
|              |               |               |                  |     |          |     |          |     | 3     |
| 92-AFB- 4225 | N             | NO V.G.       |                  |     |          |     |          |     |       |
| 92-AFB- 4226 | N             | NO V.G.       |                  |     |          |     |          |     |       |
| 92-AFB- 4227 | N             | 175 X 225     | 1                |     |          |     |          |     | 1     |
|              |               |               |                  |     |          |     |          |     | 1     |
| 92-AFB- 4228 | N             | 75 X 125      | 1                |     |          |     |          |     | 1     |
|              |               |               |                  |     |          |     |          |     | 1     |
| 93 AFB- 4001 | N             | 50 X 75       | 1                |     |          |     |          |     | 1     |
|              |               | 50 X 125      | 1                |     |          |     |          |     | 1     |
|              |               |               |                  |     |          |     |          |     | 2     |
| 93 AFB- 4002 | N             | 25 X 50       | 1                |     |          |     |          |     | 1     |
|              |               | 50 X 75       | 1                |     |          |     |          |     | 1     |
|              |               |               |                  |     |          |     |          |     | 2     |
| 93 AFB- 4003 | N             | 25 X 25       | 1                |     |          |     |          |     | 1     |
|              |               | 25 X 50       | 2                |     |          |     |          |     | 2     |
|              |               |               |                  |     |          |     |          |     | 3     |
| 93 AFB- 4004 | N             | 25 X 25       | 1                |     |          |     |          |     | 1     |
|              |               | 25 X 50       | 1                |     |          |     |          |     | 1     |
|              |               | 25 X 75       | 2                |     |          |     |          |     | 2     |
|              |               | 50 X 50       | 1                |     |          |     |          |     | 1     |
|              |               | 50 X 75       | 1                |     |          |     |          |     | 1     |
|              |               |               |                  |     |          |     |          |     | 6     |
| 93 AFB- 4005 | N             | 25 X 25       |                  |     | 1        |     |          |     | 1     |
|              |               | 50 X 50       | 1                |     |          |     |          |     | 1     |
|              |               | 375 X 475     | 1                |     |          |     |          |     | 1     |
|              |               |               |                  |     |          |     |          |     | 3     |
| 93 AFB- 4006 | N             | 25 X 25       |                  |     | 1        |     |          |     | 1     |
|              |               |               |                  |     |          |     |          |     | 1     |
| 93 AFB- 4007 | N             | NO V.G.       |                  |     |          |     |          |     |       |

| SAMPLE #     | PANNED<br>Y/N | DIAMETER (μm) | NUMBER OF GRAINS |     |          |     |          |     |       |  |
|--------------|---------------|---------------|------------------|-----|----------|-----|----------|-----|-------|--|
|              |               |               | RESHAPED         |     | MODIFIED |     | PRISTINE |     | TOTAL |  |
|              |               |               | Table            | Pan | Table    | Pan | Table    | Pan |       |  |
| 93 AFB- 4008 | N             | 25 X 25       |                  |     |          |     | 1        |     | 1     |  |
|              |               | 25 X 50       | 2                |     |          |     |          |     | 2     |  |
|              |               | 50 X 50       | 1                |     |          |     |          |     | 1     |  |
|              |               |               |                  |     |          |     |          |     | 4     |  |
| 93 AFB- 4009 | N             | 25 X 25       | 2                |     |          |     | 1        |     | 3     |  |
|              |               | 25 X 50       | 1                |     |          |     | 1        |     | 2     |  |
|              |               | 25 X 75       |                  |     | 1        |     |          |     | 1     |  |
|              |               | 50 X 50       | 2                |     |          |     |          |     | 2     |  |
|              |               | 125 X 200     | 1                |     |          |     |          |     | 1     |  |
|              |               |               |                  |     |          |     |          |     | 9     |  |
| 93 AFB- 4010 | N             | 25 X 25       | 1                |     |          |     |          |     | 1     |  |
|              |               | 50 X 50       | 1                |     |          |     |          |     | 1     |  |
|              |               |               |                  |     |          |     |          |     | 2     |  |
| 93 AFB- 4011 | N             | 25 X 25       |                  |     | 1        |     |          |     | 1     |  |
|              |               | 75 X 150      |                  |     | 1        |     |          |     | 1     |  |
|              |               |               |                  |     |          |     |          |     | 2     |  |
| 93 AFB- 4012 | Y             | 15 X 15       | 1                |     |          |     | 3        | 2   | 6     |  |
|              |               | 25 X 25       | 5                | 1   | 1        | 1   | 2        | 1   | 11    |  |
|              |               | 25 X 50       |                  | 1   |          |     | 1        |     | 2     |  |
|              |               | 25 X 75       | 1                | 1   |          |     |          |     | 2     |  |
|              |               | 50 X 50       | 1                |     |          |     |          |     | 1     |  |
|              |               | 50 X 75       | 2                |     |          |     |          |     | 2     |  |
|              |               | 75 X 100      | 1                |     |          |     |          |     | 1     |  |
|              |               | 125 X 175     | 1                |     |          |     |          |     | 1     |  |
|              |               |               |                  |     |          |     |          |     | 26    |  |
| 93 AFB- 4013 | N             | 15 X 15       | 1                |     |          |     |          |     | 1     |  |
|              |               | 25 X 50       | 1                |     |          |     |          |     | 1     |  |
|              |               |               |                  |     |          |     |          |     | 2     |  |
| 93 AFB- 4014 | N             | 15 X 15       | 2                |     |          |     | 2        | 1   | 5     |  |
|              |               | 25 X 25       | 2                | 1   | 1        |     |          |     | 4     |  |
|              |               | 25 X 50       | 3                |     |          |     |          |     | 3     |  |
|              |               | 25 X 75       | 1                |     |          |     |          |     | 1     |  |
|              |               |               |                  |     |          |     |          |     | 13    |  |
| 93 AFB- 4015 | N             | 15 X 15       | 1                |     |          |     |          |     | 1     |  |
|              |               | 25 X 25       | 1                |     |          |     |          |     | 1     |  |
|              |               |               |                  |     |          |     |          |     | 2     |  |
| 93 AFB- 4016 | N             | 25 X 25       | 4                |     | 1        |     |          |     | 5     |  |
|              |               | 25 X 50       | 1                |     |          |     |          |     | 1     |  |
|              |               | 50 X 125      | 1                |     |          |     |          |     | 1     |  |
|              |               |               |                  |     |          |     |          |     | 7     |  |
| 93 AFB- 4017 | N             | 15 X 15       |                  | 1   |          |     | 5        | 3   | 9     |  |
|              |               | 25 X 25       | 3                |     |          |     | 2        | 2   | 7     |  |
|              |               | 25 X 50       | 1                |     |          |     |          | 1   | 2     |  |
|              |               | 25 X 75       |                  |     |          |     | 1        |     | 1     |  |
|              |               | 50 X 75       | 1                |     |          | 1   | 1        |     | 3     |  |
|              |               | 50 X 100      |                  |     |          | 1   |          | 1   | 2     |  |
|              |               |               |                  |     |          |     |          |     | 24    |  |
| 93 AFB- 4018 | N             | 15 X 15       |                  |     | 2        |     | 1        |     | 3     |  |
|              |               | 25 X 25       |                  |     |          |     | 2        |     | 2     |  |
|              |               |               |                  |     |          |     |          |     | 5     |  |
| 93 AFB- 4019 | N             | 25 X 25       | 1                |     |          |     | 1        |     | 2     |  |
|              |               | 25 X 50       | 2                |     | 1        |     |          |     | 3     |  |
|              |               | 50 X 50       | 2                |     |          |     |          |     | 2     |  |
|              |               | 50 X 75       | 1                |     |          |     |          |     | 1     |  |
|              |               | 100 X 100     | 1                |     |          |     |          |     | 1     |  |
|              |               |               |                  |     |          |     |          |     | 9     |  |

| SAMPLE #     | PANNED<br>Y/N | DIAMETER (μm) | NUMBER OF GRAINS |     |          |     |          |     |       |
|--------------|---------------|---------------|------------------|-----|----------|-----|----------|-----|-------|
|              |               |               | RESHAPED         |     | MODIFIED |     | PRISTINE |     | TOTAL |
|              |               |               | Table            | Pan | Table    | Pan | Table    | Pan |       |
| 93 AFB- 4020 | N             | 25 X 50       | 1                |     |          |     |          |     | 1     |
|              |               | 50 X 50       | 1                |     |          |     |          |     | 1     |
|              |               | 50 X 75       | 1                |     |          |     |          |     | 1     |
|              |               |               |                  |     |          |     |          |     | 3     |
| 93 AFB- 4021 | N             | 25 X 50       | 1                |     |          |     |          |     | 1     |
|              |               | 50 X 50       | 1                |     |          |     |          |     | 1     |
|              |               | 50 X 100      | 1                |     |          |     |          |     | 1     |
|              |               |               |                  |     |          |     |          |     | 3     |
| 93 AFB- 4022 | Y             | 25 X 50       | 1                |     |          |     |          |     | 1     |
|              |               | 25 X 75       |                  |     | 1        |     |          |     | 1     |
|              |               |               |                  |     |          |     |          |     | 2     |
|              |               |               |                  |     |          |     |          |     |       |
| 93 AFB- 4023 | Y             | 15 X 15       | 2                | 1   |          | 1   | 1        | 3   | 8     |
|              |               | 25 X 25       | 5                | 5   | 1        |     |          | 3   | 14    |
|              |               | 25 X 50       | 2                | 1   | 1        | 1   | 2        | 1   | 8     |
|              |               | 25 X 75       | 2                |     |          |     |          | 1   | 3     |
|              |               | 25 X 100      | 1                |     |          |     |          |     | 1     |
|              |               | 50 X 75       | 2                |     |          | 1   |          |     | 3     |
|              |               | 50 X 100      |                  | 2   |          |     |          |     | 2     |
|              |               | 75 X 125      |                  | 1   |          |     |          |     | 1     |
|              |               |               |                  |     |          |     |          |     | 40    |
| 93 AFB- 4024 | N             | 25 X 25       | 1                |     |          |     |          |     | 1     |
|              |               | 25 X 50       | 2                |     |          |     |          |     | 2     |
|              |               | 50 X 50       | 1                |     |          |     |          |     | 1     |
|              |               | 50 X 75       | 1                |     |          |     |          |     | 1     |
|              |               | 75 X 75       | 1                |     |          |     |          |     | 1     |
|              |               |               |                  |     |          |     |          |     | 6     |
| 93 AFB- 4025 | N             | 25 X 25       | 1                |     | 1        |     |          |     | 2     |
|              |               | 25 X 50       | 1                |     |          |     |          |     | 1     |
|              |               |               |                  |     |          |     |          |     | 3     |
| 93 AFB- 4026 | N             | 25 X 50       | 1                |     | 1        |     |          |     | 2     |
|              |               | 25 X 75       |                  |     | 1        |     |          |     | 1     |
|              |               | 50 X 50       |                  |     | 1        |     |          |     | 1     |
|              |               |               |                  |     |          |     |          |     | 4     |
| 93 AFB- 4027 | N             | 25 X 25       |                  |     |          |     | 1        |     | 1     |
|              |               | 25 X 50       |                  |     | 1        |     |          |     | 1     |
|              |               |               |                  |     |          |     |          |     | 2     |
| 93 AFB- 4028 | N             | NO V.G.       |                  |     |          |     |          |     |       |
| 93 AFB- 4029 | N             | 25 X 25       |                  |     | 1        |     |          |     | 1     |
|              |               | 25 X 75       | 2                |     |          |     |          |     | 2     |
|              |               | 50 X 100      | 1                |     |          |     |          |     | 1     |
|              |               |               |                  |     |          |     |          |     | 4     |
| 93 AFB- 4030 | N             | 25 X 25       |                  |     |          |     | 1        |     | 1     |
|              |               |               |                  |     |          |     |          |     | 1     |
| 93 AFB- 4031 | N             | 25 X 75       |                  |     | 1        |     |          |     | 1     |
|              |               | 25 X 50       |                  |     | 1        |     |          |     | 1     |
|              |               | 50 X 75       | 1                |     |          |     |          |     | 1     |
|              |               |               |                  |     |          |     |          |     | 3     |
| 93 AFB- 4032 | N             | 25 X 25       | 2                |     |          |     |          |     | 2     |
|              |               | 50 X 50       | 1                |     |          |     |          |     | 1     |
|              |               | 75 X 125      | 1                |     |          |     |          |     | 1     |
|              |               |               |                  |     |          |     |          |     | 4     |
| 93 AFB- 4033 | N             | 25 X 25       |                  |     |          |     | 1        |     | 1     |
|              |               | 25 X 50       | 2                |     |          |     |          |     | 2     |
|              |               | 25 X 75       |                  |     | 1        |     |          |     | 1     |
|              |               | 50 X 50       | 2                |     |          |     |          |     | 2     |
|              |               | 50 X 100      | 1                |     |          |     |          |     | 1     |
|              |               |               |                  |     |          |     |          |     | 7     |

| SAMPLE #     | PANNED<br>Y/N | DIAMETER (μm) | NUMBER OF GRAINS |     |          |     |          |     |       |  |
|--------------|---------------|---------------|------------------|-----|----------|-----|----------|-----|-------|--|
|              |               |               | RESHAPED         |     | MODIFIED |     | PRISTINE |     | TOTAL |  |
|              |               |               | Table            | Pan | Table    | Pan | Table    | Pan |       |  |
| 93 AFB- 4034 | N             | 50 X 50       |                  |     | 1        |     |          |     | 1     |  |
|              |               | 50 X 50       |                  |     | 1        |     |          |     | 1     |  |
|              |               | 50 X 75       |                  |     | 1        |     |          |     | 1     |  |
|              |               |               |                  |     |          |     |          |     | 3     |  |
| 93 AFB- 4035 | N             | 15 X 15       |                  |     |          |     | 1        |     | 1     |  |
|              |               | 25 X 25       |                  |     |          |     | 2        |     | 2     |  |
|              |               | 25 X 50       | 1                |     |          |     |          |     | 1     |  |
|              |               |               |                  |     |          |     |          |     | 4     |  |
| 93 AFB- 4036 | Y             | 15 X 15       |                  |     | 1        |     |          |     | 1     |  |
|              |               | 25 X 25       | 1                |     |          |     |          |     | 1     |  |
|              |               | 25 X 50       | 3                |     |          |     |          |     | 3     |  |
|              |               | 25 X 75       | 1                |     | 1        |     |          |     | 2     |  |
|              |               | 50 X 50       | 1                |     | 2        |     |          |     | 3     |  |
|              |               | 50 X 75       | 2                |     |          | 1   |          |     | 3     |  |
|              |               | 50 X 100      |                  | 1   |          |     |          |     | 1     |  |
|              |               | 75 X 75       | 1                |     |          |     |          |     | 1     |  |
|              |               | 100 X 150     | 1                |     |          |     |          |     | 1     |  |
|              |               |               |                  |     |          |     |          |     | 16    |  |
| 93 AFB- 4037 | N             | 25 X 50       | 1                |     |          |     |          |     | 1     |  |
|              |               |               |                  |     |          |     |          |     | 1     |  |
| 93 AFB- 4038 | N             | 50 X 100      | 1                |     |          |     |          |     | 1     |  |
|              |               |               |                  |     |          |     |          |     | 1     |  |
| 93 AFB- 4039 | N             | 25 X 25       |                  |     |          |     | 1        |     | 1     |  |
|              |               | 25 X 25       |                  |     | 1        |     |          |     | 1     |  |
|              |               | 50 X 100      | 1                |     |          |     |          |     | 1     |  |
|              |               |               |                  |     |          |     |          |     | 3     |  |
| 93 AFB- 4040 | N             | 25 X 25       |                  |     | 1        |     |          |     | 1     |  |
|              |               | 25 X 100      | 1                |     |          |     |          |     | 1     |  |
|              |               | 50 X 50       | 1                |     |          |     |          |     | 1     |  |
|              |               |               |                  |     |          |     |          |     | 3     |  |
| 93 AFB- 4041 | N             | NO V.G.       |                  |     |          |     |          |     |       |  |
| 93 AFB- 4042 | N             | 25 X 25       |                  |     |          |     | 1        |     | 1     |  |
|              |               | 25 X 50       |                  |     |          |     | 1        |     | 1     |  |
|              |               |               |                  |     |          |     |          |     | 2     |  |
| 93 AFB- 4043 | N             | 50 X 50       | 1                |     |          |     |          |     | 1     |  |
|              |               | 50 X 75       | 1                |     |          |     |          |     | 1     |  |
|              |               |               |                  |     |          |     |          |     | 2     |  |
| 93 AFB- 4044 | N             | 50 X 75       | 1                |     |          |     |          |     | 1     |  |
|              |               | 50 X 100      | 2                |     |          |     |          |     | 2     |  |
|              |               | 75 X 125      | 1                |     |          |     |          |     | 1     |  |
|              |               |               |                  |     |          |     |          |     | 4     |  |
| 93 AFB- 4045 | N             | 25 X 50       | 1                |     |          |     |          |     | 1     |  |
|              |               | 50 X 50       |                  |     | 1        |     |          |     | 1     |  |
|              |               | 50 X 75       | 1                |     |          |     |          |     | 1     |  |
|              |               | 50 X 100      |                  |     | 1        |     |          |     | 1     |  |
|              |               |               |                  |     |          |     |          |     | 4     |  |
| 93 AFB- 4046 | N             | 25 X 50       | 1                |     |          |     |          |     | 1     |  |
|              |               | 50 X 50       | 2                |     |          |     |          |     | 2     |  |
|              |               |               |                  |     |          |     |          |     | 3     |  |
| 93 AFB- 4047 | N             | 25 X 50       | 1                |     |          |     | 1        |     | 2     |  |
|              |               | 50 X 50       |                  |     |          |     | 1        |     | 1     |  |
|              |               | 50 X 75       |                  |     |          |     | 1        |     | 1     |  |
|              |               | 150 X 25      | 1                |     |          |     |          |     | 1     |  |
|              |               |               |                  |     |          |     |          |     | 5     |  |



| SAMPLE #     | PANNED<br>Y/N | DIAMETER (μm) | NUMBER OF GRAINS |     |          |     |          |     |       |
|--------------|---------------|---------------|------------------|-----|----------|-----|----------|-----|-------|
|              |               |               | RESHAPED         |     | MODIFIED |     | PRISTINE |     | TOTAL |
|              |               |               | Table            | Pan | Table    | Pan | Table    | Pan |       |
| 93 AFB- 4048 | Y             | 25 X 25       | 4                |     |          |     |          | 1   | 5     |
|              |               | 25 X 50       | 2                |     | 2        |     |          | 1   | 5     |
|              |               | 25 X 75       | 1                |     |          |     |          |     | 1     |
|              |               | 50 X 50       | 1                |     |          |     |          |     | 1     |
|              |               | 50 X 75       | 2                |     |          |     |          |     | 2     |
|              |               | 50 X 100      | 1                | 1   |          |     |          |     | 2     |
|              |               | 75 X 100      | 1                | 1   |          |     |          |     | 2     |
|              |               | 75 X 100      |                  | 1   |          |     |          |     | 1     |
|              |               | 100 X 100     | 1                |     |          |     |          |     | 1     |
|              |               |               |                  |     |          |     |          |     | 20    |
| 93 AFB- 4049 | N             | 25 X 25       | 1                |     | 2        |     |          |     | 3     |
|              |               | 25 X 50       | 1                |     | 1        |     |          |     | 2     |
|              |               | 50 X 50       | 2                |     |          |     |          |     | 2     |
|              |               |               |                  |     |          |     |          |     | 7     |
| 93 AFB- 4050 | Y             | 25 X 25       | 2                |     |          |     |          |     | 2     |
|              |               | 25 X 50       | 2                |     |          |     |          |     | 2     |
|              |               | 50 X 50       | 1                |     |          |     |          |     | 1     |
|              |               | 50 X 75       | 3                | 1   |          |     |          |     | 4     |
|              |               | 50 X 100      | 1                |     |          |     |          |     | 1     |
|              |               | 75 X 125      | 1                |     |          |     |          |     | 1     |
|              |               | 100 X 150     | 1                |     |          |     |          |     | 1     |
|              |               |               |                  |     |          |     |          |     | 12    |
| 93 AFB- 4051 | N             | 50 X 50       | 1                |     |          |     |          |     | 1     |
|              |               |               |                  |     |          |     |          |     | 1     |
| 93 AFB- 4052 | N             | 25 X 25       | 1                |     |          |     |          |     | 1     |
|              |               | 25 X 50       |                  |     | 1        |     |          |     | 1     |
|              |               | 50 X 50       | 3                |     |          |     |          |     | 3     |
|              |               | 75 X 100      | 2                |     |          |     |          |     | 2     |
|              |               |               |                  |     |          |     |          |     | 7     |
| 93 AFB- 4053 | N             | 25 X 50       | 1                |     |          |     |          |     | 1     |
|              |               | 50 X 100      | 1                |     |          |     |          |     | 1     |
|              |               |               |                  |     |          |     |          |     | 2     |
| 93 AFB- 4054 | N             | NO V.G.       |                  |     |          |     |          |     |       |
| 93 AFB- 4055 | N             | 15 X 15       |                  |     |          |     | 1        |     | 1     |
|              |               | 25 X 125      | 1                |     |          |     |          |     | 1     |
|              |               |               |                  |     |          |     |          |     | 2     |
| 93 AFB- 4056 | N             | 25 X 50       | 1                |     |          |     |          |     | 1     |
|              |               | 75 X 100      | 1                |     |          |     |          |     | 1     |
|              |               |               |                  |     |          |     |          |     | 2     |
| 93 AFB- 4057 | N             | 15 X 15       | 1                |     |          |     |          |     | 1     |
|              |               | 25 X 25       | 2                |     |          |     |          |     | 2     |
|              |               | 25 X 75       | 2                |     |          |     |          |     | 2     |
|              |               | 50 X 75       |                  |     | 1        |     |          |     | 1     |
|              |               | 100 X 100     | 1                |     |          |     |          |     | 1     |
|              |               |               |                  |     |          |     |          |     | 7     |
| 93 AFB- 4058 | N             | 25 X 25       | 1                |     |          |     |          |     | 1     |
|              |               | 50 X 100      | 1                |     |          |     |          |     | 1     |
|              |               |               |                  |     |          |     |          |     | 2     |
| 93 AFB- 4061 | N             | 275 X 300     | 1                |     |          |     |          |     | 1     |
|              |               |               |                  |     |          |     |          |     | 1     |
| 93 AFB- 4062 | N             | NO V.G.       |                  |     |          |     |          |     |       |
| 93 AFB- 4063 | N             | 50 X 50       | 1                |     |          |     |          |     | 1     |
|              |               | 50 X 75       | 1                |     |          |     |          |     | 1     |
|              |               |               |                  |     |          |     |          |     | 2     |
| 93 AFB- 4064 | N             | 50 X 50       | 1                |     |          |     |          |     | 1     |
|              |               |               |                  |     |          |     |          |     | 1     |

| SAMPLE #     | PANNED<br>Y/N | DIAMETER (μm) | NUMBER OF GRAINS |     |          |     |          |     |       |  |
|--------------|---------------|---------------|------------------|-----|----------|-----|----------|-----|-------|--|
|              |               |               | RESHAPED         |     | MODIFIED |     | PRISTINE |     | TOTAL |  |
|              |               |               | Table            | Pan | Table    | Pan | Table    | Pan |       |  |
| 93 AFB- 4065 | N             | 25 X 25       | 1                |     |          |     |          |     | 1     |  |
|              |               | 25 X 50       | 4                |     |          |     |          |     | 4     |  |
|              |               | 50 X 50       |                  |     | 1        |     |          |     | 1     |  |
|              |               | 50 X 100      | 1                |     |          |     |          |     | 1     |  |
|              |               |               |                  |     |          |     |          |     | 7     |  |
| 93 AFB- 4066 | N             | NO V.G.       |                  |     |          |     |          |     |       |  |
| 93 AFB- 4068 | N             | 50 X 50       | 1                |     | 1        |     | 1        |     | 3     |  |
|              |               | 50 X 75       | 1                |     |          |     |          |     | 1     |  |
|              |               | 50 X 100      | 2                |     |          |     |          |     | 2     |  |
|              |               | 225 X 325     | 1                |     |          |     |          |     | 1     |  |
|              |               |               |                  |     |          |     |          |     | 7     |  |
| 93 AFB- 4069 | N             | NO V.G.       |                  |     |          |     |          |     |       |  |
| 93 AFB- 4070 | N             | 25 X 25       | 1                |     |          |     | 1        |     | 2     |  |
|              |               | 25 X 50       |                  |     |          |     | 1        |     | 1     |  |
|              |               |               |                  |     |          |     |          |     | 3     |  |
| 93 AFB- 4071 | N             | 25 X 50       | 1                |     | 1        |     |          |     | 2     |  |
|              |               | 25 X 75       | 2                |     |          |     |          |     | 2     |  |
|              |               | 50 X 100      | 1                |     |          |     |          |     | 1     |  |
|              |               |               |                  |     |          |     |          |     | 5     |  |
| 93 AFB- 4073 | N             | 15 X 15       |                  |     | 1        |     |          |     | 1     |  |
|              |               | 25 X 25       |                  |     | 1        |     | 1        |     | 2     |  |
|              |               | 25 X 50       |                  |     |          |     | 1        |     | 1     |  |
|              |               | 25 X 75       | 1                |     |          |     |          |     | 1     |  |
|              |               | 50 X 75       | 1                |     |          |     |          |     | 1     |  |
|              |               |               |                  |     |          |     |          |     | 6     |  |
| 93 AFB- 4074 | Y             | 15 X 15       |                  |     | 1        |     |          |     | 1     |  |
|              |               | 25 X 25       | 1                |     | 2        |     | 1        |     | 4     |  |
|              |               | 25 X 50       | 3                |     | 2        |     |          |     | 5     |  |
|              |               | 25 X 50       | 1                |     |          |     |          |     | 1     |  |
|              |               | 50 X 50       | 1                |     | 1        |     |          |     | 2     |  |
|              |               | 50 X 75       | 2                |     |          |     |          |     | 2     |  |
|              |               | 50 X 100      | 2                |     |          |     |          |     | 2     |  |
|              |               |               |                  |     |          |     |          |     | 17    |  |
| 93 AFB- 4075 | N             | 25 X 25       | 1                |     |          |     |          |     | 1     |  |
|              |               | 25 X 50       | 2                |     |          |     |          |     | 2     |  |
|              |               |               |                  |     |          |     |          |     | 3     |  |
| 93 AFB- 4076 | N             | NO V.G.       |                  |     |          |     |          |     |       |  |
| 93 AFB- 4077 | N             | NO V.G.       |                  |     |          |     |          |     |       |  |
| 93 AFB- 4079 | N             | NO V.G.       |                  |     |          |     |          |     |       |  |
| 93 AFB- 4080 | N             | NO V.G.       |                  |     |          |     |          |     |       |  |
| 93 AFB- 4081 | N             | NO V.G.       |                  |     |          |     |          |     |       |  |
| 93 AFB- 4082 | N             | NO V.G.       |                  |     |          |     |          |     |       |  |
| 93 AFB- 4084 | N             | NO V.G.       |                  |     |          |     |          |     |       |  |
| 93 AFB- 4085 | N             | 75 X 100      |                  |     | 1        |     |          |     | 1     |  |
|              |               |               |                  |     |          |     |          |     | 1     |  |
|              |               |               |                  |     |          |     |          |     |       |  |
| 93 AFB- 4086 | N             | 15 X 15       |                  |     | 1        |     |          |     | 1     |  |
|              |               | 25 X 75       |                  |     | 1        |     |          |     | 1     |  |
|              |               | 50 X 75       | 1                |     |          |     |          |     | 1     |  |
|              |               |               |                  |     |          |     |          |     | 3     |  |
| 93 AFB- 4087 | N             | NO V.G.       |                  |     |          |     |          |     |       |  |

| SAMPLE #     | PANNED<br>Y/N | DIAMETER (μm) | NUMBER OF GRAINS |     |          |     |          |     |       |
|--------------|---------------|---------------|------------------|-----|----------|-----|----------|-----|-------|
|              |               |               | RESHAPED         |     | MODIFIED |     | PRISTINE |     | TOTAL |
|              |               |               | Table            | Pan | Table    | Pan | Table    | Pan |       |
| 93 AFB- 4088 | N             | 25 X 25       | 1                |     |          |     |          |     | 1     |
|              |               | 25 X 75       | 1                |     |          |     |          |     | 1     |
|              |               |               |                  |     |          |     |          |     | 2     |
| 93 AFB- 4089 | N             | 25 X 50       | 1                |     |          |     |          |     | 1     |
|              |               |               |                  |     |          |     |          |     | 1     |
| 93 AFB- 4090 | N             | 25 X 50       | 2                |     |          |     |          |     | 2     |
|              |               | 50 X 50       | 1                |     |          |     |          |     | 1     |
|              |               | 50 X 75       | 1                |     |          |     |          |     | 1     |
|              |               |               |                  |     |          |     |          |     | 4     |
| 93 AFB- 4091 | N             | 25 X 50       | 1                |     |          |     |          |     | 1     |
|              |               | 75 X 175      | 1                |     |          |     |          |     | 1     |
|              |               | 125 X 150     | 1                |     |          |     |          |     | 1     |
|              |               |               |                  |     |          |     |          |     | 3     |
| 93 AFB- 4092 | N             | 25 X 75       | 1                |     |          |     |          |     | 1     |
|              |               |               |                  |     |          |     |          |     | 1     |
| 93 AFB- 4093 | N             | 25 X 25       | 1                |     |          |     |          |     | 1     |
|              |               | 50 X 50       | 1                |     |          |     |          |     | 1     |
|              |               | 100 X 100     | 1                |     |          |     |          |     | 1     |
|              |               |               |                  |     |          |     |          |     | 3     |
| 93 AFB- 4094 | N             | 25 X 25       | 1                |     |          |     |          |     | 1     |
|              |               | 25 X 50       | 1                |     |          |     |          |     | 1     |
|              |               | 50 X 50       | 1                |     |          |     |          |     | 1     |
|              |               |               |                  |     |          |     |          |     | 3     |
| 93 AFB- 4095 | N             | 25 X 25       | 2                |     |          |     |          |     | 2     |
|              |               | 25 X 50       | 2                |     |          |     |          |     | 2     |
|              |               |               |                  |     |          |     |          |     | 4     |
| 93 AFB- 4096 | N             | NO V.G.       |                  |     |          |     |          |     |       |
| 93 AFB- 4097 | N             | 25 X 25       | 2                |     |          |     |          |     | 2     |
|              |               | 25 X 50       | 1                |     |          |     |          |     | 1     |
|              |               | 100 X 250     | 1                |     |          |     |          |     | 1     |
|              |               |               |                  |     |          |     |          |     | 4     |
| 93 AFB- 4098 | N             | 25 X 25       | 1                |     |          |     |          |     | 1     |
|              |               | 50 X 50       | 1                |     |          |     |          |     | 1     |
|              |               | 100 X 125     | 1                |     |          |     |          |     | 1     |
|              |               | 100 X 150     | 1                |     |          |     |          |     | 1     |
|              |               |               |                  |     |          |     |          |     | 4     |
| 93 AFB- 4099 | N             | 25 X 25       | 1                |     |          |     |          |     | 1     |
|              |               | 50 X 50       | 3                |     |          |     |          |     | 3     |
|              |               | 50 X 75       | 2                |     |          |     |          |     | 2     |
|              |               | 75 X 100      | 1                |     |          |     |          |     | 1     |
|              |               |               |                  |     |          |     |          |     | 7     |
| 93 AFB- 4100 | N             | 25 X 50       | 1                |     |          |     |          |     | 1     |
|              |               | 50 X 125      | 1                |     |          |     |          |     | 1     |
|              |               | 75 X 100      | 1                |     |          |     |          |     | 1     |
|              |               | 125 X 225     |                  | 1   |          |     |          |     | 1     |
|              |               |               |                  |     |          |     |          |     | 4     |
| 93 AFB- 4101 | N             | NO V.G.       |                  |     |          |     |          |     |       |
| 93 AFB- 4102 | N             | 15 X 15       | 1                |     |          |     |          |     | 1     |
|              |               | 25 X 25       | 2                |     |          |     |          |     | 2     |
|              |               | 25 X 50       | 3                |     |          |     |          |     | 3     |
|              |               | 50 X 50       | 1                |     |          |     |          |     | 1     |
|              |               |               |                  |     |          |     |          |     | 7     |

| SAMPLE #     | PANNED<br>Y/N | DIAMETER (μm) | NUMBER OF GRAINS |     |          |     |          |     |       |  |
|--------------|---------------|---------------|------------------|-----|----------|-----|----------|-----|-------|--|
|              |               |               | RESHAPED         |     | MODIFIED |     | PRISTINE |     | TOTAL |  |
|              |               |               | Table            | Pan | Table    | Pan | Table    | Pan |       |  |
| 93 AFB- 4103 | N             | 25 X 25       | 1                |     |          |     |          |     | 1     |  |
|              |               | 25 X 50       | 1                |     |          |     |          |     | 1     |  |
|              |               | 25 X 75       | 1                |     |          |     |          |     | 1     |  |
|              |               | 50 X 75       | 2                |     |          |     |          |     | 2     |  |
|              |               | 125 X 150     | 1                |     |          |     |          |     | 1     |  |
|              |               |               |                  |     |          |     |          |     | 6     |  |
| 93 AFB- 4104 | N             | 25 X 25       | 1                |     |          |     |          |     | 1     |  |
|              |               | 25 X 50       | 1                |     |          |     |          |     | 1     |  |
|              |               | 75 X 125      | 1                |     |          |     |          |     | 1     |  |
|              |               |               |                  |     |          |     |          |     | 3     |  |
| 93 AFB- 4105 | N             | 25 X 25       | 2                |     |          |     |          |     | 2     |  |
|              |               | 25 X 50       | 1                |     |          |     |          |     | 1     |  |
|              |               | 25 X 75       | 2                |     |          |     |          |     | 2     |  |
|              |               | 50 X 50       | 1                |     |          |     |          |     | 1     |  |
|              |               | 50 X 75       | 1                |     |          |     |          |     | 1     |  |
|              |               | 75 X 100      | 1                |     |          |     |          |     | 1     |  |
|              |               |               |                  |     |          |     |          |     | 8     |  |
| 93 AFB- 4106 | N             | 15 X 15       | 1                |     |          |     |          |     | 1     |  |
|              |               | 25 X 25       | 2                |     |          |     |          |     | 2     |  |
|              |               | 25 X 50       | 2                |     |          |     |          |     | 2     |  |
|              |               | 25 X 100      | 1                |     |          |     |          |     | 1     |  |
|              |               | 50 X 50       | 1                |     |          |     |          |     | 1     |  |
|              |               | 50 X 75       | 2                |     |          |     |          |     | 2     |  |
|              |               |               |                  |     |          |     |          |     | 9     |  |
| 93 AFB- 4107 | N             | 25 X 50       | 1                |     |          |     |          |     | 1     |  |
|              |               | 50 X 75       | 1                |     |          |     |          |     | 1     |  |
|              |               |               |                  |     |          |     |          |     | 2     |  |
| 93 AFB- 4108 | N             | 25 X 50       | 1                |     |          |     |          |     | 1     |  |
|              |               | 50 X 75       | 1                |     |          |     |          |     | 1     |  |
|              |               |               |                  |     |          |     |          |     | 2     |  |
| 93 AFB- 4109 | N             | 25 X 50       |                  |     | 1        |     |          |     | 1     |  |
|              |               |               |                  |     |          |     |          |     | 1     |  |
| 93 AFB- 4110 | N             | NO V.G.       |                  |     |          |     |          |     |       |  |
| 93 AFB- 4111 | N             | 25 X 25       | 2                |     |          |     |          |     | 2     |  |
|              |               | 50 X 100      | 1                |     |          |     |          |     | 1     |  |
|              |               |               |                  |     |          |     |          |     | 3     |  |
| 93 AFB- 4112 | Y             | 15 X 15       |                  |     |          |     | 1        |     | 1     |  |
|              |               | 25 X 50       | 1                | 1   |          | 1   | 2        |     | 5     |  |
|              |               | 25 X 25       |                  | 1   |          |     |          |     | 1     |  |
|              |               | 50 X 50       | 1                |     |          |     |          |     | 1     |  |
|              |               | 50 X 75       |                  |     | 1        |     | 1        |     | 2     |  |
|              |               | 50 X 100      | 1                |     |          |     |          |     | 1     |  |
|              |               | 50 X 125      |                  |     | 1        |     |          |     | 1     |  |
|              |               | 175 X 225     | 1                |     |          |     |          |     | 1     |  |
|              |               |               |                  |     |          |     |          |     | 13    |  |
| 93 AFB- 4113 | N             | NO V.G.       |                  |     |          |     |          |     |       |  |
| 93 AFB- 4114 | N             | 25 X 25       |                  |     | 2        |     |          |     | 2     |  |
|              |               | 25 X 50       |                  |     | 1        |     | 1        |     | 2     |  |
|              |               | 50 X 50       |                  |     | 1        |     |          |     | 1     |  |
|              |               | 50 X 75       |                  |     | 1        |     |          |     | 1     |  |
|              |               |               |                  |     |          |     |          |     | 6     |  |
| 93 AFB- 4115 | N             | 100 X 175     | 1                |     |          |     |          |     | 1     |  |
|              |               | 125 X 225     |                  |     |          |     | 1        |     | 1     |  |
|              |               | 125 X 325     |                  |     | 1        |     |          |     | 1     |  |
|              |               |               |                  |     |          |     |          |     | 3     |  |

| SAMPLE #     | PANNED<br>Y/N | DIAMETER (μm) | NUMBER OF GRAINS |     |          |     |          |     |       |  |
|--------------|---------------|---------------|------------------|-----|----------|-----|----------|-----|-------|--|
|              |               |               | RESHAPED         |     | MODIFIED |     | PRISTINE |     | TOTAL |  |
|              |               |               | Table            | Pan | Table    | Pan | Table    | Pan |       |  |
| 93 AFB- 4116 | N             | 25 X 25       |                  |     | 1        |     | 1        |     | 2     |  |
|              |               | 75 X 125      | 1                |     |          |     |          |     | 1     |  |
|              |               | 100 X 125     | 1                |     |          |     |          |     | 1     |  |
|              |               |               |                  |     |          |     |          |     | 4     |  |
| 93 AFB- 4118 | N             | 25 X 50       | 2                |     | 1        |     |          |     | 3     |  |
|              |               | 50 X 50       | 1                |     |          |     |          |     | 1     |  |
|              |               | 75 X 150      | 1                |     |          |     |          |     | 1     |  |
|              |               |               |                  |     |          |     |          |     | 5     |  |
| 93 AFB- 4121 | N             | 50 X 75       | 1                |     |          |     |          |     | 1     |  |
|              |               |               |                  |     |          |     |          |     | 1     |  |
| 93 AFB- 4122 | N             | NO V.G.       |                  |     |          |     |          |     |       |  |
| 93 AFB- 4123 | N             | 25 X 25       | 2                |     |          |     |          |     | 2     |  |
|              |               | 25 X 50       | 1                |     |          |     |          |     | 1     |  |
|              |               |               |                  |     |          |     |          |     | 3     |  |
| 93 AFB- 4124 | N             | NO V.G.       |                  |     |          |     |          |     |       |  |
| 93 AFB- 4125 | N             | 15 X 15       | 2                |     |          |     |          |     | 2     |  |
|              |               | 25 X 25       | 1                |     |          |     |          |     | 1     |  |
|              |               | 25 X 75       | 1                |     |          |     |          |     | 1     |  |
|              |               | 150 X 250     | 1                |     |          |     |          |     | 1     |  |
|              |               |               |                  |     |          |     |          |     | 5     |  |
| 93 AFB- 4126 | N             | NO V.G.       |                  |     |          |     |          |     |       |  |
| 93 AFB- 4127 | N             | 15 X 15       | 2                |     |          |     |          |     | 2     |  |
|              |               | 25 X 25       | 1                |     |          |     |          |     | 1     |  |
|              |               | 25 X 50       | 2                |     |          |     |          |     | 2     |  |
|              |               |               |                  |     |          |     |          |     | 5     |  |
| 93 AFB- 4128 | N             | NO V.G.       |                  |     |          |     |          |     |       |  |
| 4129         | N             | 75 X 125      | 1                |     |          |     |          |     | 1     |  |
|              |               | 100 X 125     | 1                |     |          |     |          |     | 1     |  |
|              |               |               |                  |     |          |     |          |     | 2     |  |
| 93 AFB- 4130 | N             | NO V.G.       |                  |     |          |     |          |     |       |  |
| 93 AFB- 4133 | N             | 25 X 25       | 1                |     |          |     |          |     | 1     |  |
|              |               | 25 X 50       | 1                |     |          |     |          |     | 1     |  |
|              |               |               |                  |     |          |     |          |     | 2     |  |
| 93 AFB- 4146 | Y             | 15 X 15       |                  |     |          |     |          | 2   | 2     |  |
|              |               | 25 X 25       |                  | 1   |          |     |          | 1   | 2     |  |
|              |               | 25 X 50       | 1                | 1   | 2        | 1   | 1        |     | 6     |  |
|              |               | 25 X 100      |                  |     |          |     | 1        |     | 1     |  |
|              |               | 25 X 125      |                  |     |          |     | 1        |     | 1     |  |
|              |               | 50 X 50       |                  |     | 1        |     |          |     | 1     |  |
|              |               | 50 X 75       | 1                |     | 1        |     | 1        |     | 3     |  |
|              |               | 50 X 125      | 1                |     |          |     | 1        |     | 2     |  |
|              |               |               |                  |     |          |     |          |     | 18    |  |
| 93 AFB- 4147 | N             | 25 X 50       |                  |     |          |     | 1        |     | 1     |  |
|              |               | 50 X 75       | 1                |     |          |     |          |     | 1     |  |
|              |               | 50 X 100      | 2                |     |          |     |          |     | 2     |  |
|              |               |               |                  |     |          |     |          |     | 4     |  |
| 93 AFB- 4149 | N             | 25 X 50       |                  |     |          |     | 1        |     | 1     |  |
|              |               | 50 X 50       | 2                |     |          |     |          |     | 2     |  |
|              |               | 225 X 325     | 1                |     |          |     |          |     | 1     |  |
|              |               | 275 X 550     | 1                |     |          |     |          |     | 1     |  |
|              |               |               |                  |     |          |     |          |     | 5     |  |
| 93 AFB- 4150 | N             | 15 X 15       |                  |     |          |     | 1        |     | 1     |  |
|              |               | 25 X 25       | 1                |     |          |     |          |     | 1     |  |
|              |               | 50 X 75       | 1                |     |          |     |          |     | 1     |  |
|              |               |               |                  |     |          |     |          |     | 3     |  |



| SAMPLE # | PANNED<br>Y/N | DIAMETER (μm) | NUMBER OF GRAINS |     |          |     |          |     |       |
|----------|---------------|---------------|------------------|-----|----------|-----|----------|-----|-------|
|          |               |               | RESHAPED         |     | MODIFIED |     | PRISTINE |     | TOTAL |
|          |               |               | Table            | Pan | Table    | Pan | Table    | Pan |       |

|              |   |           |   |   |   |  |   |   |    |
|--------------|---|-----------|---|---|---|--|---|---|----|
| 93 AFB- 4152 | N | NO V.G.   |   |   |   |  |   |   |    |
| 93 AFB- 4154 | Y | 15 X 15   | 1 |   |   |  |   |   | 1  |
|              |   | 25 X 25   | 2 | 1 | 1 |  |   | 1 | 5  |
|              |   | 25 X 50   | 4 | 1 | 1 |  |   |   | 6  |
|              |   | 50 X 100  | 1 |   |   |  |   |   | 1  |
|              |   | 50 X 125  |   | 1 |   |  |   |   | 1  |
|              |   |           |   |   |   |  |   |   | 14 |
| 93 AFB- 4155 | N | 375 X 425 | 1 |   |   |  |   |   | 1  |
|              |   |           |   |   |   |  |   |   | 1  |
| 93 AFB- 4156 | N | 25 X 25   | 1 |   |   |  |   |   | 1  |
|              |   | 25 X 50   | 1 |   |   |  |   |   | 1  |
|              |   | 25 X 75   | 1 |   |   |  |   |   | 1  |
|              |   | 50 X 75   | 2 |   |   |  |   |   | 2  |
|              |   | 75 X 175  | 1 |   |   |  |   |   | 1  |
|              |   | 125 X 200 | 1 |   |   |  |   |   | 1  |
|              |   |           |   |   |   |  |   |   | 7  |
| 93 AFB- 4157 | N | 25 X 25   | 1 |   | 1 |  |   |   | 2  |
|              |   | 25 X 50   | 1 |   |   |  |   |   | 1  |
|              |   |           |   |   |   |  |   |   | 3  |
| 93 AFB- 4158 | N | 25 X 25   | 3 |   | 1 |  | 1 |   | 5  |
|              |   | 25 X 50   | 1 |   |   |  |   |   | 1  |
|              |   | 50 X 75   | 1 |   |   |  |   |   | 1  |
|              |   |           |   |   |   |  |   |   | 7  |
| 93 AFB- 4159 | N | 25 X 25   | 1 |   |   |  |   |   | 1  |
|              |   | 25 X 50   | 2 |   |   |  |   |   | 2  |
|              |   | 25 X 75   | 1 |   |   |  |   |   | 1  |
|              |   | 75 X 125  | 1 |   |   |  |   |   | 1  |
|              |   |           |   |   |   |  |   |   | 5  |
| 93 AFB- 4170 | N | 15 X 15   | 2 |   |   |  |   |   | 2  |
|              |   | 25 X 25   | 2 |   |   |  |   |   | 2  |
|              |   | 25 X 50   | 1 |   |   |  |   |   | 1  |
|              |   | 25 X 100  | 1 |   |   |  |   |   | 1  |
|              |   | 50 X 75   | 1 |   | 1 |  |   |   | 2  |
|              |   | 275 X 700 | 1 |   |   |  |   |   | 1  |
|              |   |           |   |   |   |  |   |   | 9  |
| 93 AFB- 4171 | N | 75 X 75   | 1 |   |   |  |   |   | 1  |
|              |   |           |   |   |   |  |   |   | 1  |
| 93 AFB- 4172 | N | 50 X 75   | 1 |   |   |  |   |   | 1  |
|              |   |           |   |   |   |  |   |   | 1  |
| 93 AFB- 4173 | N | 25 X 50   | 1 |   |   |  |   |   | 1  |
|              |   | 50 X 75   | 1 |   |   |  |   |   | 1  |
|              |   | 150 X 225 | 1 |   |   |  |   |   | 1  |
|              |   | 175 X 250 | 1 |   |   |  |   |   | 1  |
|              |   |           |   |   |   |  |   |   | 4  |
| 93 AFB- 4174 | N | 25 X 50   | 1 |   |   |  |   |   | 1  |
|              |   | 25 X 75   | 1 |   |   |  |   |   | 1  |
|              |   | 50 X 75   | 1 |   |   |  |   |   | 1  |
|              |   |           |   |   |   |  |   |   | 3  |
| 93 AFB- 4175 | N | 25 X 50   | 1 |   |   |  |   |   | 1  |
|              |   |           |   |   |   |  |   |   | 1  |
| 93 AFB- 4176 | N | 25 X 25   | 1 |   |   |  |   |   | 1  |
|              |   | 50 X 50   | 1 |   |   |  |   |   | 1  |
|              |   | 50 X 125  | 1 |   |   |  |   |   | 1  |
|              |   | 75 X 75   | 1 |   |   |  |   |   | 1  |
|              |   |           |   |   |   |  |   |   | 4  |

| SAMPLE #     | PANNED<br>Y/N | DIAMETER (μm) | NUMBER OF GRAINS |     |          |     |          |     |       |
|--------------|---------------|---------------|------------------|-----|----------|-----|----------|-----|-------|
|              |               |               | RESHAPED         |     | MODIFIED |     | PRISTINE |     | TOTAL |
|              |               |               | Table            | Pan | Table    | Pan | Table    | Pan |       |
| 93 AFB- 4178 | N             | 50 X 75       | 1                |     |          |     |          |     | 1     |
|              |               | 75 X 100      |                  |     |          |     | 1        |     | 1     |
|              |               |               |                  |     |          |     |          |     | 2     |
| 93 AFB- 4179 | N             | 25 X 75       | 1                |     |          |     |          |     | 1     |
|              |               | 25 X 50       | 1                |     |          |     |          |     | 1     |
|              |               | 125 X 250     |                  |     | 1        |     |          |     | 1     |
|              |               |               |                  |     |          |     |          |     | 3     |
| 93 AFB- 4180 | Y             | 15 X 15       |                  | 2   |          |     | 4        | 2   | 8     |
|              |               | 25 X 25       | 2                | 2   |          |     | 3        | 2   | 9     |
|              |               | 25 X 50       | 1                | 1   |          |     | 1        |     | 3     |
|              |               | 50 X 75       | 1                |     |          |     |          |     | 1     |
|              |               | 50 X 100      | 1                |     |          |     |          |     | 1     |
|              |               | 50 X 125      | 1                |     |          |     |          |     | 1     |
|              |               | 150 X 225     | 1                |     |          |     |          |     | 1     |
|              |               |               |                  |     |          |     |          |     | 24    |
| 93 AFB- 4181 | N             | 25 X 50       | 1                |     |          |     |          |     | 1     |
|              |               | 50 X 100      | 1                |     |          |     |          |     | 1     |
|              |               |               |                  |     |          |     |          |     | 2     |
| 93 AFB- 4182 | N             | 25 X 50       | 2                |     |          |     |          |     | 2     |
|              |               | 75 X 75       | 1                |     |          |     |          |     | 1     |
|              |               |               |                  |     |          |     |          |     | 3     |
| 93 AFB- 4184 | N             | 25 X 75       | 1                |     |          |     |          |     | 1     |
|              |               |               |                  |     |          |     |          |     | 1     |
| 93 AFB- 4186 | N             | 25 X 25       | 4                |     |          |     |          |     | 4     |
|              |               | 25 X 50       | 2                |     |          |     |          |     | 2     |
|              |               | 50 X 50       | 1                |     |          |     |          |     | 1     |
|              |               | 50 X 125      | 1                |     |          |     |          |     | 1     |
|              |               |               |                  |     |          |     |          |     | 8     |
| 93 AFB- 4187 | N             | 25 X 25       | 1                |     |          |     |          |     | 1     |
|              |               | 50 X 50       | 1                |     |          |     |          |     | 1     |
|              |               | 50 X 100      | 1                |     |          |     |          |     | 1     |
|              |               |               |                  |     |          |     |          |     | 3     |
| 93 AFB- 4189 | N             | 75 X 100      | 1                |     |          |     |          |     | 1     |
|              |               |               |                  |     |          |     |          |     | 1     |
| 93 AFB- 4190 | N             | 25 X 50       | 1                |     |          |     |          |     | 1     |
|              |               |               |                  |     |          |     |          |     | 1     |
| 93 AFB- 4191 | N             | 25 X 50       | 1                |     |          |     |          |     | 1     |
|              |               | 25 X 75       | 1                |     |          |     |          |     | 1     |
|              |               | 175 X 275     | 1                |     |          |     |          |     | 1     |
|              |               |               |                  |     |          |     |          |     | 3     |
| 93 AFB- 4192 | N             | 25 X 50       | 1                |     |          |     |          |     | 1     |
|              |               | 50 X 75       | 1                |     |          |     |          |     | 1     |
|              |               | 50 X 125      | 1                |     |          |     |          |     | 1     |
|              |               |               |                  |     |          |     |          |     | 3     |
| 93 AFB- 4193 | N             | 15 X 15       |                  |     | 1        |     |          |     | 1     |
|              |               |               |                  |     |          |     |          |     | 1     |
| 93 AFB- 4194 | N             | 100 X 250     | 1                |     |          |     |          |     | 1     |
|              |               |               |                  |     |          |     |          |     | 1     |
| 93 AFB- 4195 | N             | 50 X 100      |                  |     | 1        |     |          |     | 1     |
|              |               |               |                  |     |          |     |          |     | 1     |
| 93 AFB- 4196 | N             | NO V.G.       |                  |     |          |     |          |     |       |
| 93 AFB- 4197 | N             | 15 X 15       | 1                |     |          |     |          |     | 1     |
|              |               | 25 X 25       | 1                |     |          |     |          |     | 1     |
|              |               |               |                  |     |          |     |          |     | 2     |

| SAMPLE #     | PANNED<br>Y/N | DIAMETER (μm) | NUMBER OF GRAINS |     |          |     |          |     | TOTAL |
|--------------|---------------|---------------|------------------|-----|----------|-----|----------|-----|-------|
|              |               |               | RESHAPED         |     | MODIFIED |     | PRISTINE |     |       |
|              |               |               | Table            | Pan | Table    | Pan | Table    | Pan |       |
| 93 AFB- 4198 | N             | 25 X 50       | 1                |     |          |     |          |     | 1     |
| 93 AFB- 4199 | N             | 25 X 25       |                  |     | 1        |     |          |     | 1     |
|              |               | 50 X 75       | 1                |     |          |     |          |     | 1     |
|              |               |               |                  |     |          |     |          |     | 2     |
| 93 AFB- 4200 | N             | 25 X 25       | 1                |     |          |     |          |     | 1     |
|              |               | 25 X 50       |                  |     | 1        |     |          |     | 1     |
|              |               | 50 X 50       | 1                |     |          |     |          |     | 1     |
|              |               | 50 X 75       | 1                |     | 1        |     |          |     | 2     |
|              |               |               |                  |     |          |     |          |     | 5     |
| 93 AFB- 4201 | N             | 25 X 25       |                  |     | 1        |     |          |     | 1     |
|              |               | 50 X 50       | 1                |     |          |     |          |     | 1     |
|              |               |               |                  |     |          |     |          |     | 2     |
| 93 AFB- 4202 | N             | 25 X 50       | 1                |     |          |     |          |     | 1     |
|              |               | 50 X 50       | 1                |     |          |     |          |     | 1     |
|              |               | 50 X 125      | 1                |     |          |     |          |     | 1     |
|              |               |               |                  |     |          |     |          |     | 3     |
| 93 AFB- 4203 | N             | 50 X 50       | 1                |     |          |     |          |     | 1     |
|              |               | 50 X 125      | 1                |     |          |     |          |     | 1     |
|              |               |               |                  |     |          |     |          |     | 2     |
| 93 AFB- 4205 | N             | 25 X 50       | 1                |     |          |     |          |     | 1     |
|              |               | 75 X 100      | 1                |     |          |     |          |     | 1     |
|              |               |               |                  |     |          |     |          |     | 2     |
| 93 AFB- 4206 | Y             | 25 X 25       | 2                | 2   | 1        |     |          |     | 5     |
|              |               | 25 X 50       | 2                |     |          |     |          |     | 2     |
|              |               | 50 X 50       | 1                | 1   | 1        |     |          |     | 3     |
|              |               | 50 X 75       | 2                | 1   |          |     |          |     | 3     |
|              |               | 50 X 100      | 1                |     |          |     |          |     | 1     |
|              |               | 75 X 75       | 1                |     |          |     |          |     | 1     |
|              |               |               |                  |     |          |     |          |     | 15    |
| 93 AFB- 4207 | N             | 50 X 50       | 1                |     |          |     |          |     | 1     |
|              |               |               |                  |     |          |     |          |     | 1     |
| 93 AFB- 4208 | N             | 25 X 50       | 1                |     |          |     |          |     | 1     |
|              |               |               |                  |     |          |     |          |     | 1     |
| 93 AFB- 4209 | N             | NO V.G.       |                  |     |          |     |          |     |       |
| 93 AFB- 4210 | N             | 25 X 50       |                  |     | 1        |     |          |     | 1     |
|              |               |               |                  |     |          |     |          |     | 1     |
| 93 AFB- 4211 | N             | 25 X 75       | 1                |     |          |     |          |     | 1     |
|              |               |               |                  |     |          |     |          |     | 1     |
| 93 AFB- 4212 | Y             | 15 X 15       |                  | 1   |          |     |          |     | 1     |
|              |               | 25 X 25       | 5                | 1   | 1        |     |          |     | 7     |
|              |               | 25 X 50       | 8                | 3   | 1        |     |          |     | 12    |
|              |               | 25 X 75       | 2                |     |          |     |          |     | 2     |
|              |               | 50 X 50       | 3                | 1   |          |     |          |     | 4     |
|              |               | 50 X 75       | 2                |     |          |     |          |     | 2     |
|              |               | 50 X 100      | 1                | 1   |          |     |          |     | 2     |
|              |               | 50 X 150      |                  | 2   |          |     |          |     | 2     |
|              |               | 75 X 75       | 1                |     |          |     |          |     | 1     |
|              |               | 75 X 150      |                  | 1   |          |     |          |     | 1     |
|              |               | 75 X 200      |                  | 1   |          |     |          |     | 1     |
|              |               | 100 X 125     |                  | 1   |          |     |          |     | 1     |
|              |               |               |                  |     |          |     |          |     | 36    |
| 93 AFB- 4213 | N             | NO V.G.       |                  |     |          |     |          |     |       |

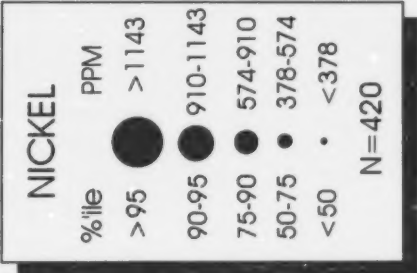
| SAMPLE #     | PANNED<br>Y/N | DIAMETER (μm) | NUMBER OF GRAINS |     |          |     |          |     |       |  |
|--------------|---------------|---------------|------------------|-----|----------|-----|----------|-----|-------|--|
|              |               |               | RESHAPED         |     | MODIFIED |     | PRISTINE |     | TOTAL |  |
|              |               |               | Table            | Pan | Table    | Pan | Table    | Pan |       |  |
| 93 AFB- 4214 | N             | 25 X 50       | 1                |     |          |     |          |     | 1     |  |
|              |               | 50 X 50       | 3                |     |          |     |          |     | 3     |  |
|              |               | 50 X 75       | 2                |     |          |     |          |     | 2     |  |
|              |               | 50 X 100      | 1                |     |          |     |          |     | 1     |  |
|              |               | 75 X 75       |                  |     | 1        |     |          |     | 1     |  |
|              |               |               |                  |     |          |     |          |     | 8     |  |
| 93 AFB- 4215 | N             | 50 X 50       | 1                |     |          |     |          |     | 1     |  |
|              |               | 50 X 75       | 2                |     | 1        |     |          |     | 3     |  |
|              |               | 50 X 100      | 1                |     |          |     |          |     | 1     |  |
|              |               | 75 X 200      | 1                |     |          |     |          |     | 1     |  |
|              |               |               |                  |     |          |     |          |     | 6     |  |
| 93 AFB- 4216 | N             | NO V.G.       |                  |     |          |     |          |     |       |  |
| 93 AFB- 4217 | N             | 50 X 50       | 2                |     |          |     |          |     | 2     |  |
|              |               | 50 X 75       | 2                |     |          |     |          |     | 2     |  |
|              |               |               |                  |     |          |     |          |     | 4     |  |
| 93 AFB- 4218 | N             | 25 X 25       | 1                |     |          |     |          |     | 1     |  |
|              |               | 25 X 50       | 1                |     |          |     |          |     | 1     |  |
|              |               | 50 X 75       | 2                |     |          |     |          |     | 2     |  |
|              |               | 50 X 125      | 1                |     |          |     |          |     | 1     |  |
|              |               |               |                  |     |          |     |          |     | 5     |  |
| 93 AFB- 4219 | N             | 50 X 50       | 2                |     |          |     |          |     | 2     |  |
|              |               | 75 X 75       | 1                |     |          |     |          |     | 1     |  |
|              |               |               |                  |     |          |     |          |     | 3     |  |
| 93 AFB- 4220 | N             | 50 X 50       | 3                |     |          |     |          |     | 3     |  |
|              |               | 50 X 75       | 1                |     |          |     |          |     | 1     |  |
|              |               |               |                  |     |          |     |          |     | 4     |  |
| 93 AFB- 4221 | N             | 75 X 75       | 1                |     |          |     |          |     | 1     |  |
|              |               |               |                  |     |          |     |          |     | 1     |  |
| 93 AFB- 4222 | N             | 50 X 75       | 1                |     |          |     |          |     | 1     |  |
|              |               | 75 X 100      | 2                |     |          |     |          |     | 2     |  |
|              |               | 100 X 150     | 1                |     |          |     |          |     | 1     |  |
|              |               | 150 X 200     | 1                |     |          |     |          |     | 1     |  |
|              |               |               |                  |     |          |     |          |     | 5     |  |
| 93 AFB- 4223 | N             | 25 X 25       | 1                |     |          |     |          |     | 1     |  |
|              |               | 125 X 150     | 1                |     |          |     |          |     | 1     |  |
|              |               |               |                  |     |          |     |          |     | 2     |  |
| 93 AFB- 4225 | Y             | 15 X 50       | 1                |     |          |     |          |     | 1     |  |
|              |               | 25 X 25       | 2                |     |          |     |          |     | 2     |  |
|              |               | 25 X 50       | 2                |     |          |     |          |     | 2     |  |
|              |               | 25 X 75       | 1                |     | 1        |     |          |     | 2     |  |
|              |               | 50 X 50       | 3                | 1   |          |     |          |     | 4     |  |
|              |               | 50 X 75       | 2                |     |          |     |          |     | 2     |  |
|              |               | 50 X 125      | 1                |     |          |     |          |     | 1     |  |
|              |               |               |                  |     |          |     |          |     | 14    |  |
| 93 AFB- 4226 | N             | 50 X 75       | 1                |     |          |     |          |     | 1     |  |
|              |               | 50 X 100      | 1                |     |          |     |          |     | 1     |  |
|              |               |               |                  |     |          |     |          |     | 2     |  |
| 93 AFB- 4227 | N             | 25 X 25       | 1                |     |          |     |          |     | 1     |  |
|              |               | 25 X 50       | 1                |     |          |     |          |     | 1     |  |
|              |               | 50 X 75       | 1                |     |          |     |          |     | 1     |  |
|              |               | 75 X 125      | 1                |     |          |     |          |     | 1     |  |
|              |               |               |                  |     |          |     |          |     | 4     |  |
| 93 AFB- 4228 | N             | 50 X 50       | 1                |     |          |     |          |     | 1     |  |
|              |               | 50 X 75       | 2                |     |          |     |          |     | 2     |  |
|              |               | 50 X 100      | 1                |     |          |     |          |     | 1     |  |
|              |               | 100 X 125     | 1                |     |          |     |          |     | 1     |  |
|              |               |               |                  |     |          |     |          |     | 5     |  |

| SAMPLE #     | PANNED<br>Y/N | DIAMETER (μm) | NUMBER OF GRAINS |     |          |     |          |     |       |   |
|--------------|---------------|---------------|------------------|-----|----------|-----|----------|-----|-------|---|
|              |               |               | RESHAPED         |     | MODIFIED |     | PRISTINE |     | TOTAL |   |
|              |               |               | Table            | Pan | Table    | Pan | Table    | Pan |       |   |
| 93 AFB- 4229 | N             | 25 X 25       | 1                |     |          |     |          |     |       | 1 |
|              |               | 125 X 175     | 1                |     |          |     |          |     |       | 1 |
|              |               |               |                  |     |          |     |          |     |       | 2 |

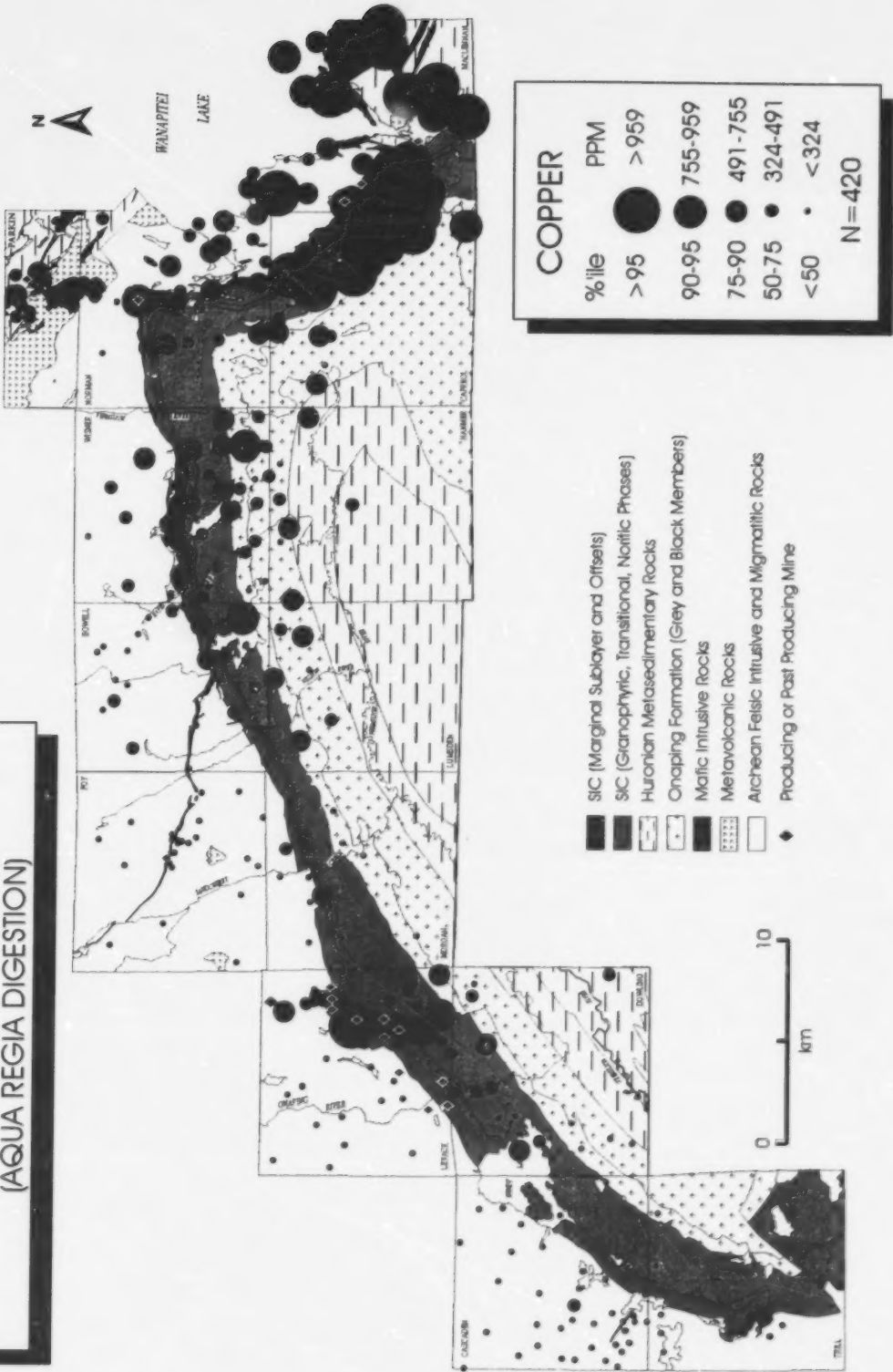


**Appendix D. Regional geochemical plots for humus (Aqua Regia Digestion)**

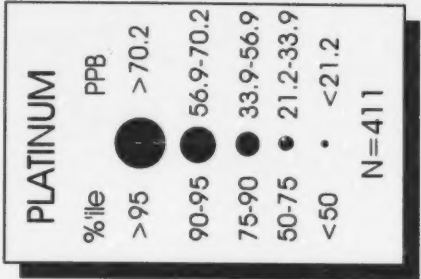
NICKEL IN THE  $<0.177$  mm  
FRACTION OF HUMUS  
(AQUA REGIA DIGESTION)



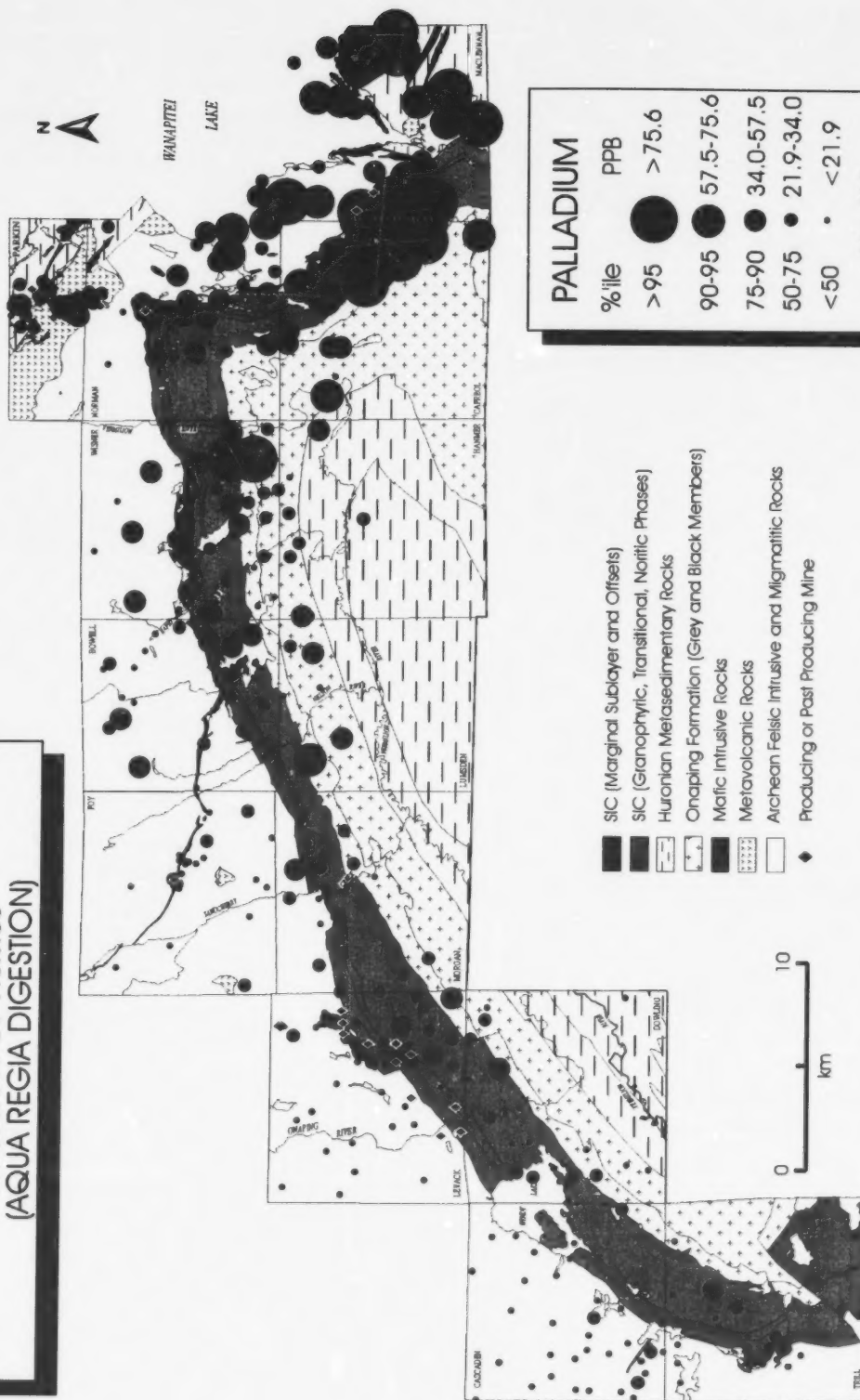
COPPER IN THE  $<0.177\text{ }\mu\text{m}$   
FRACTION OF HUMUS  
(AQUA REGIA DIGESTION)



PLATINUM IN THE  $<0.177$  mm  
FRACTION OF HUMUS  
(AQUA REGIA DIGESTION)

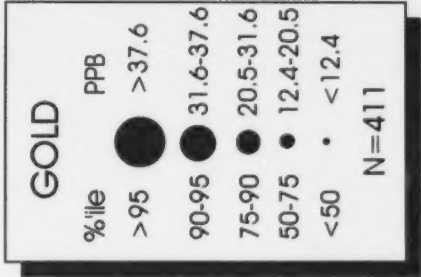


PALLADIUM IN THE <0.177 mm  
FRACTION OF HUMUS  
(AQUA REGIA DIGESTION)

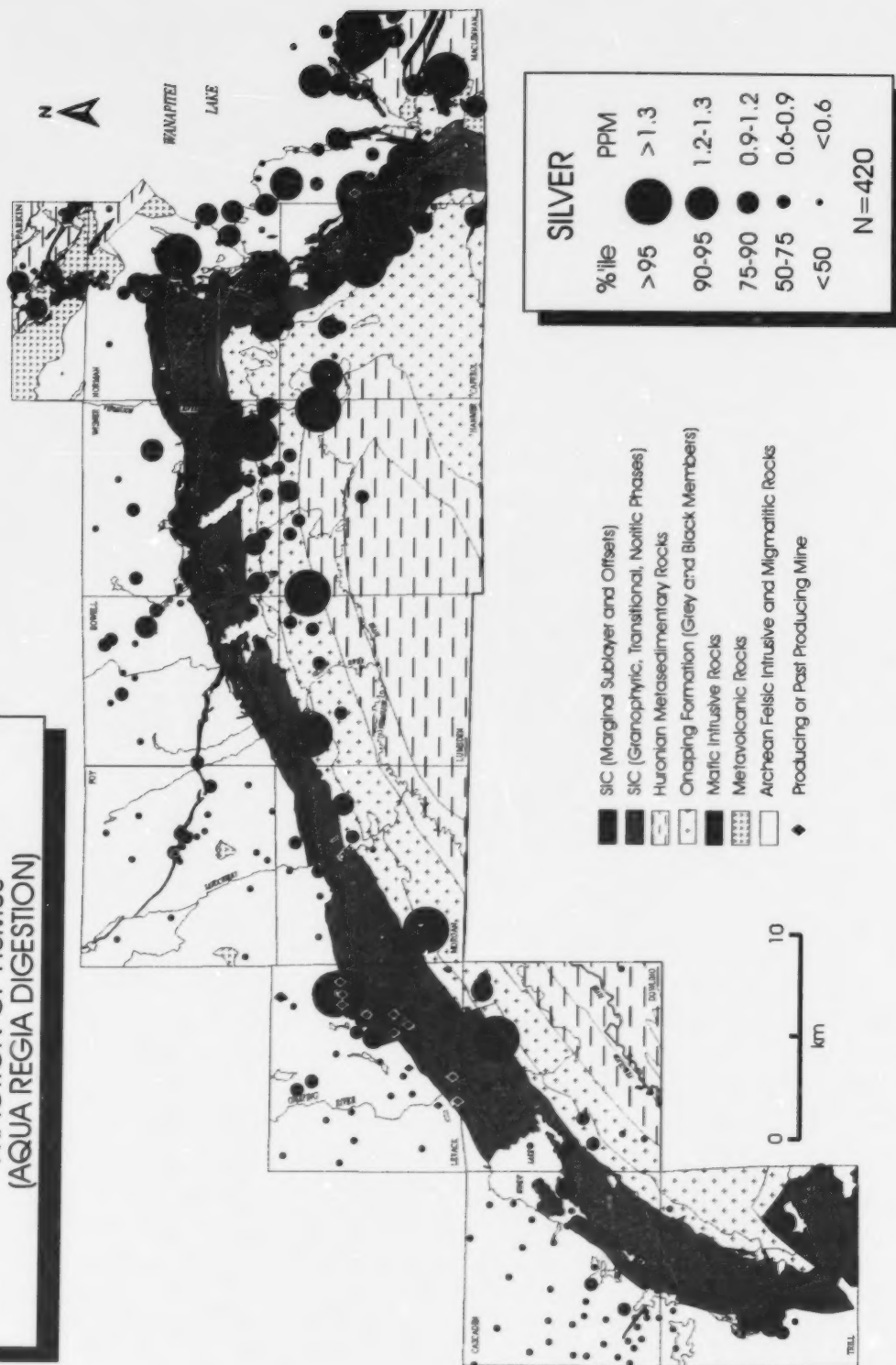




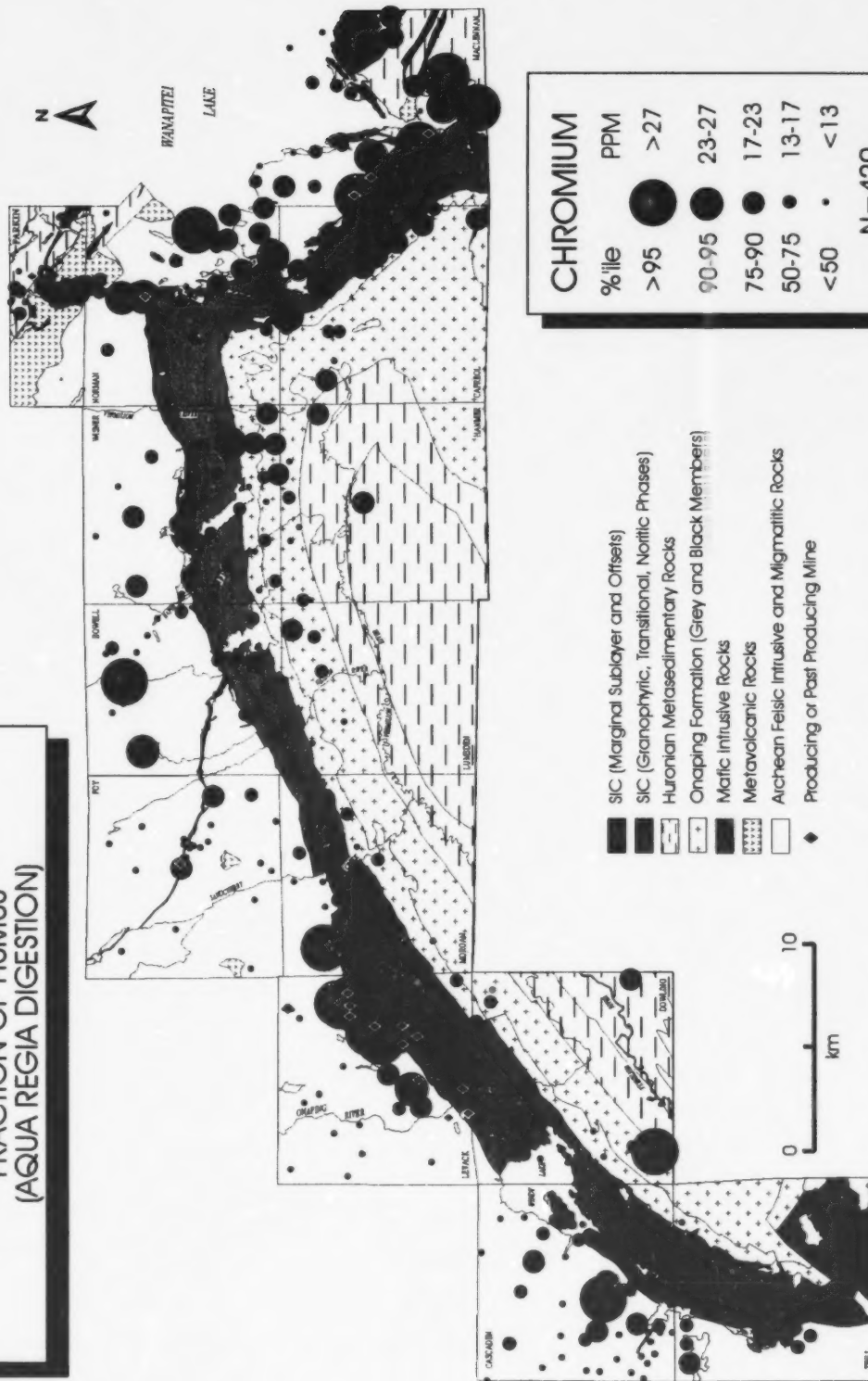
GOLD IN THE  $<0.177$  mm  
FRACTION OF HUMUS  
(AQUA REGIA DIGESTION)



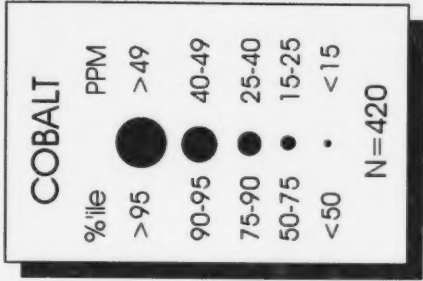
SILVER IN THE <0.177 mm  
FRACTION OF HUMUS  
(AQUA REGIA DIGESTION)



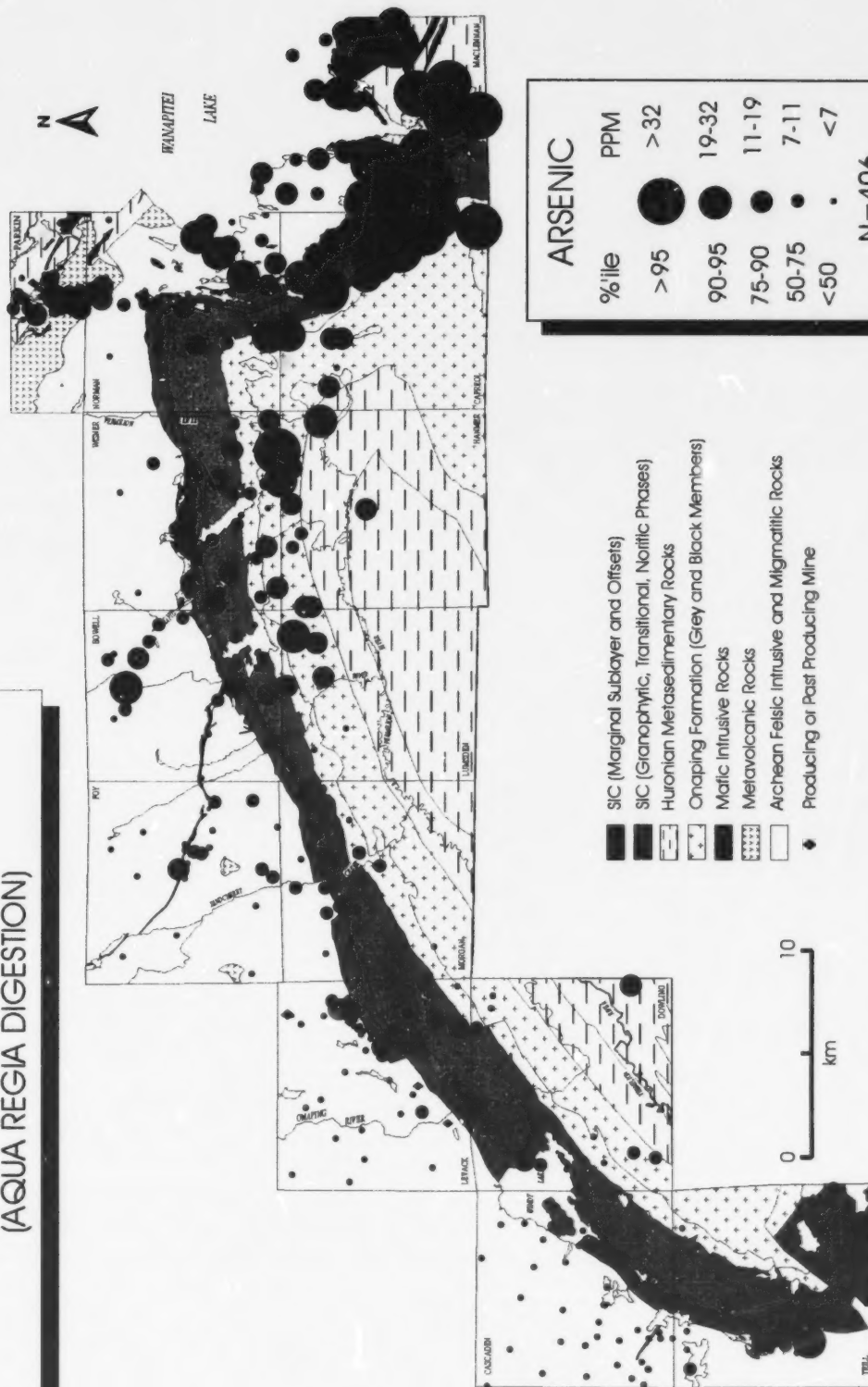
CHROMIUM IN THE <0.177 mm  
FRACTION OF HUMUS  
(AQUA REGIA DIGESTION)



COBALT IN THE  $<0.177 \text{ mm}$   
FRACTION OF HUMUS  
(AQUA REGIA DIGESTION)

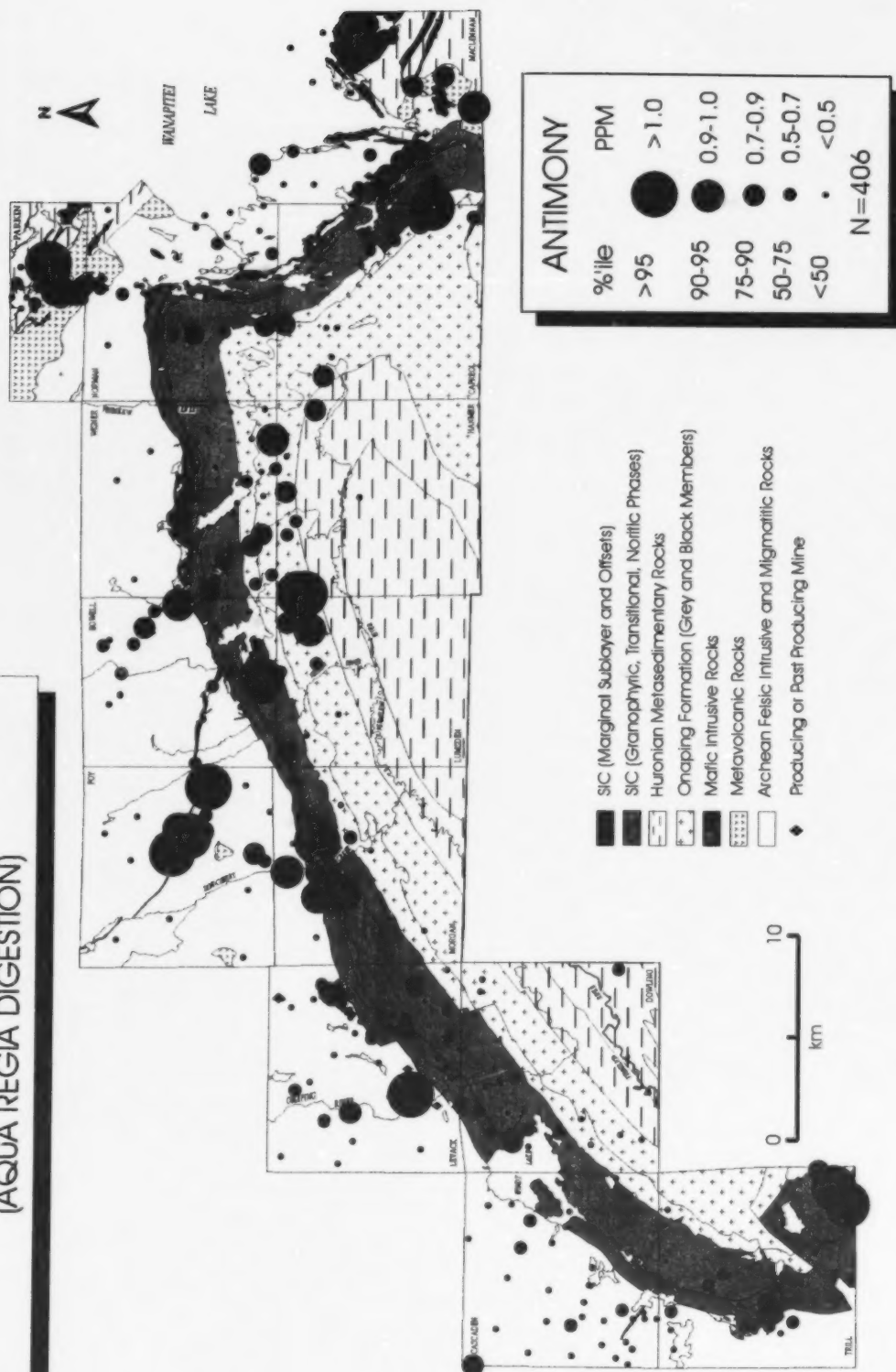


ARSENIC IN THE <0.177 mm  
FRACTION OF HUMUS  
(AQUA REGIA DIGESTION)

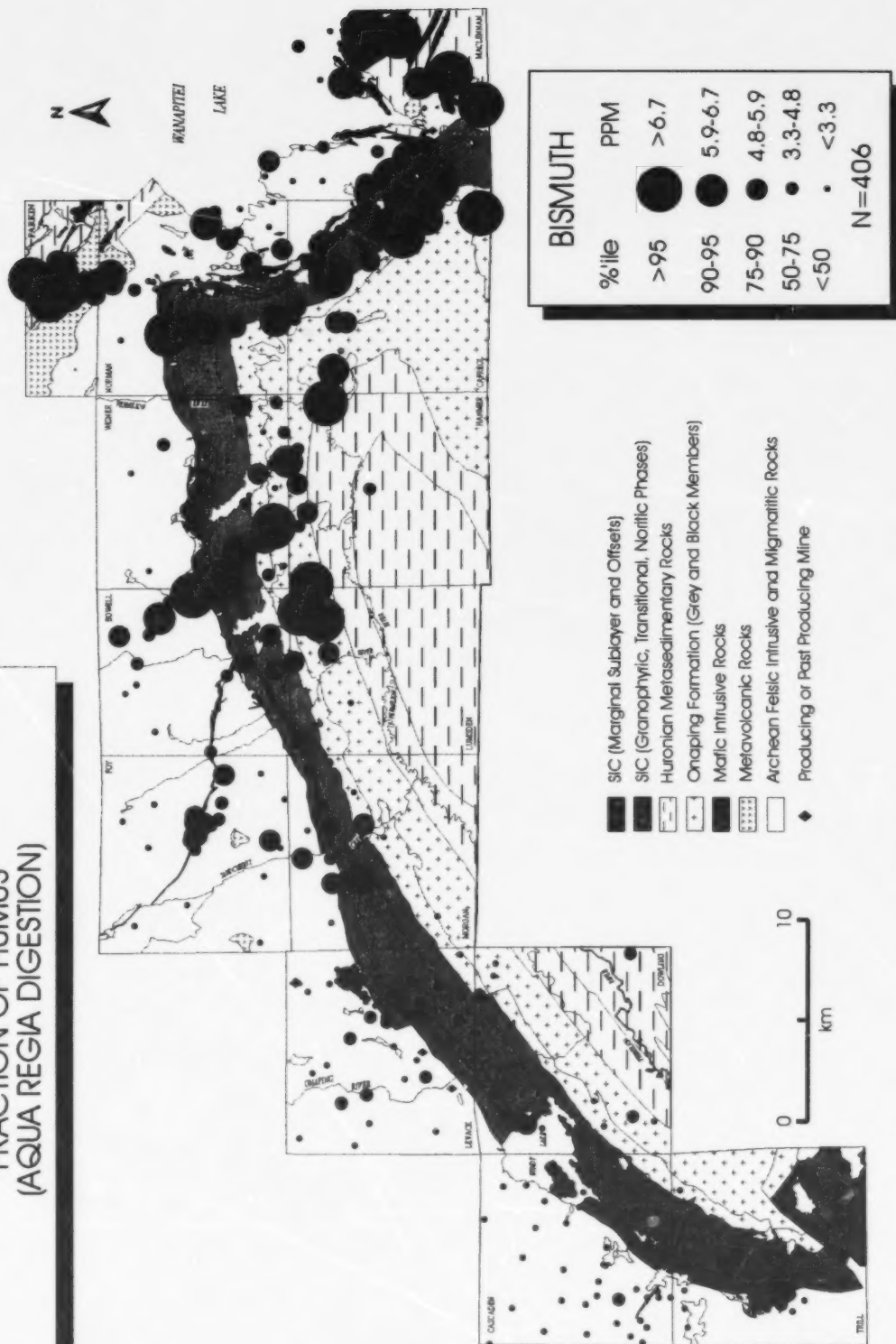




ANTIMONY IN THE  $<0.177$  mm  
FRACTION OF HUMUS  
(AQUA REGIA DIGESTION)



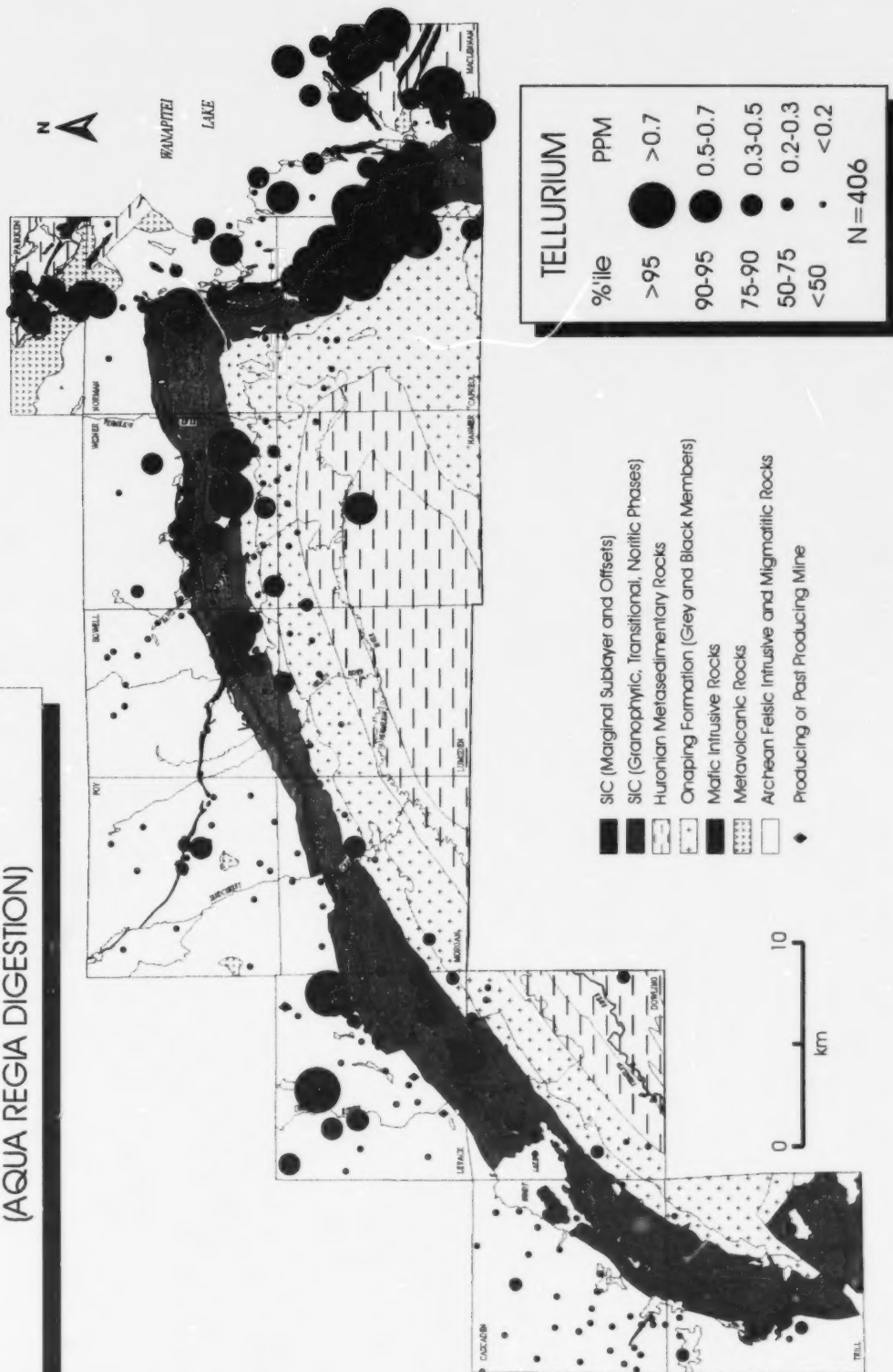
BISMUTH IN THE <0.177 mm  
FRACTION OF HUMUS  
(AQUA REGIA DIGESTION)



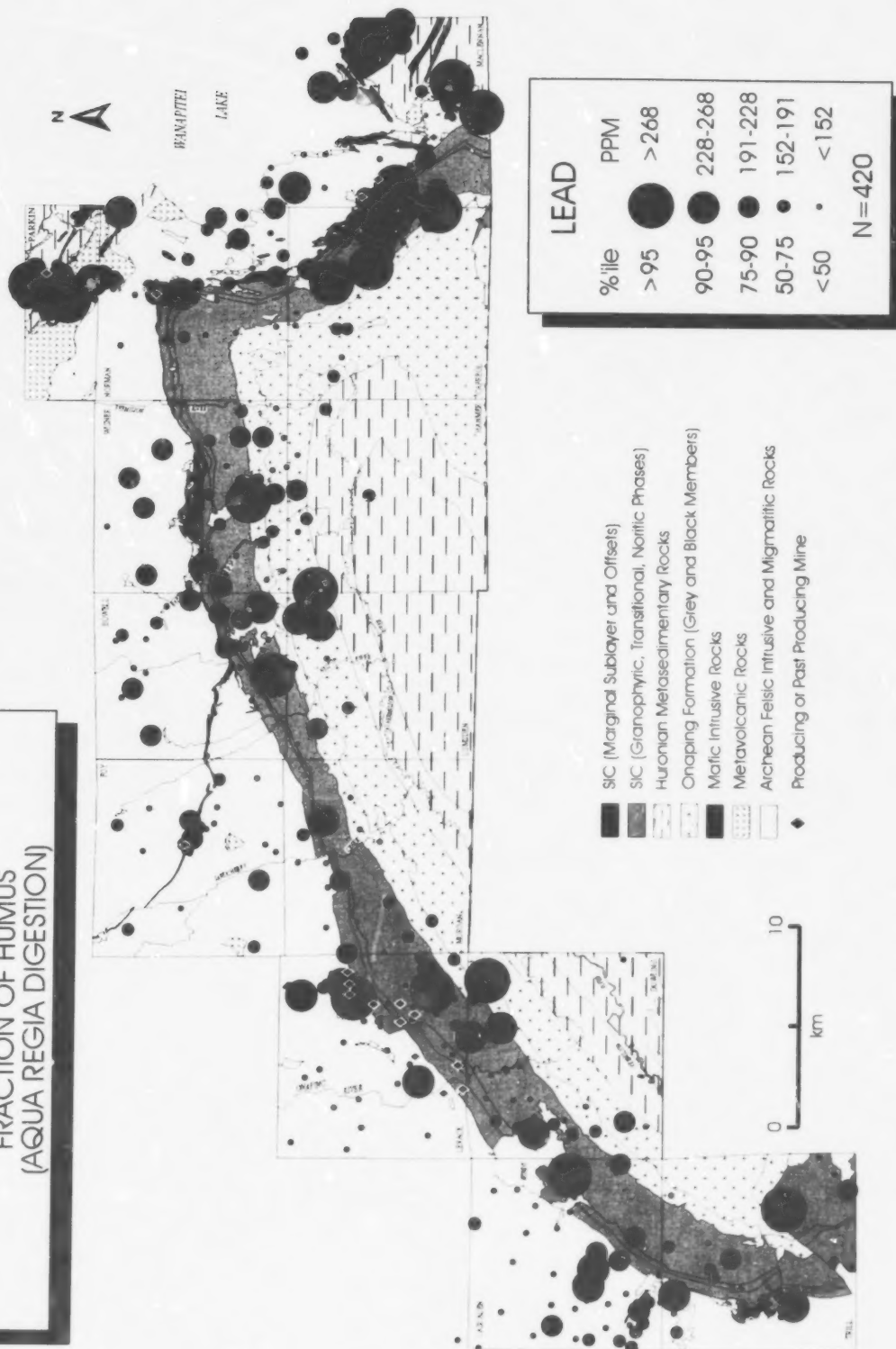
SELENIUM IN THE  $<0.177\text{ }\mu\text{m}$   
FRACTION OF HUMUS  
(AQUA REGIA DIGESTION)



TELLURIUM IN THE <0.177 mm  
FRACTION OF HUMUS  
(AQUA REGIA DIGESTION)



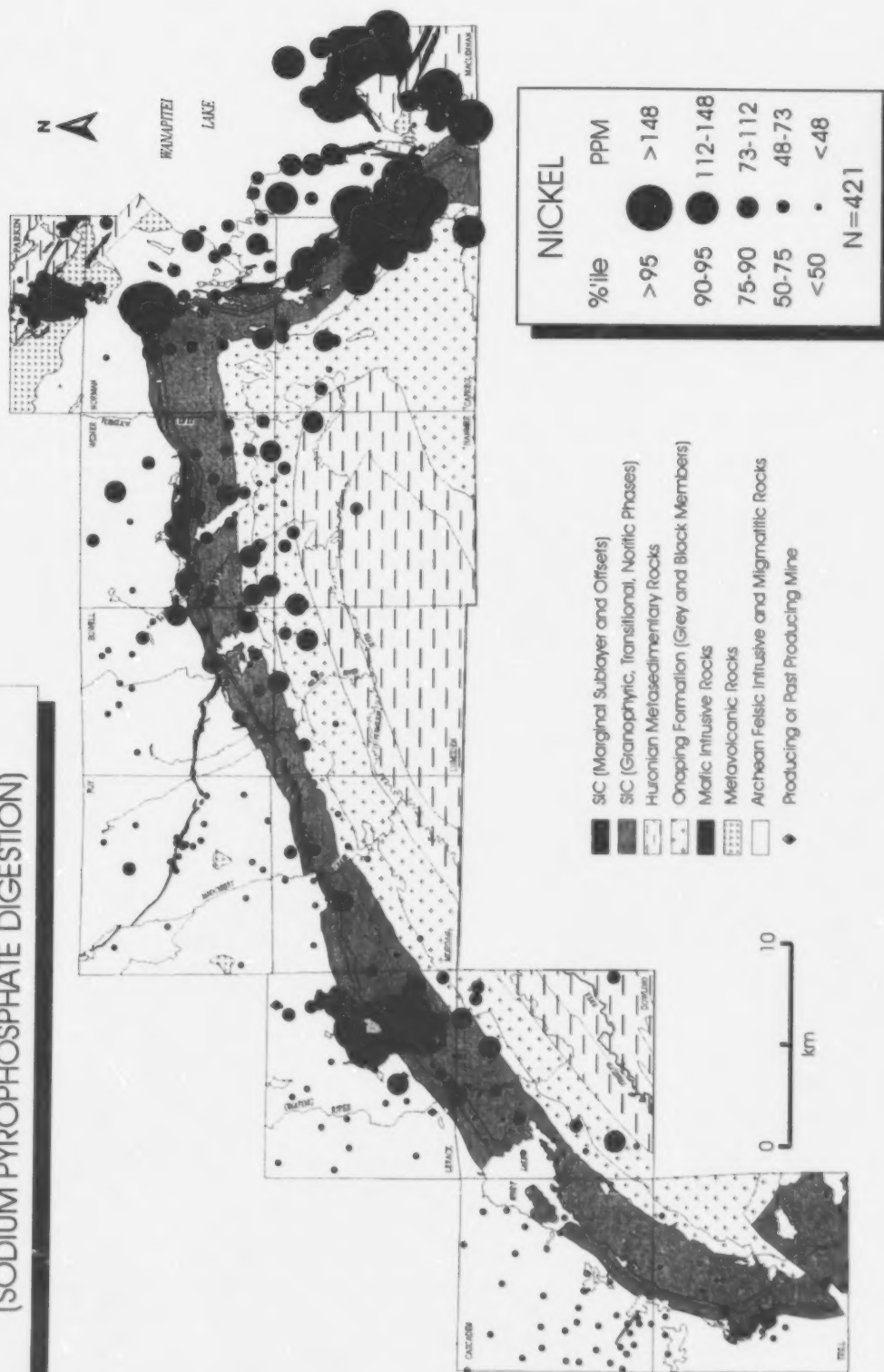
LEAD IN THE <0.177 mm  
FRACTION OF HUMUS  
(AQUA REGIA DIGESTION)



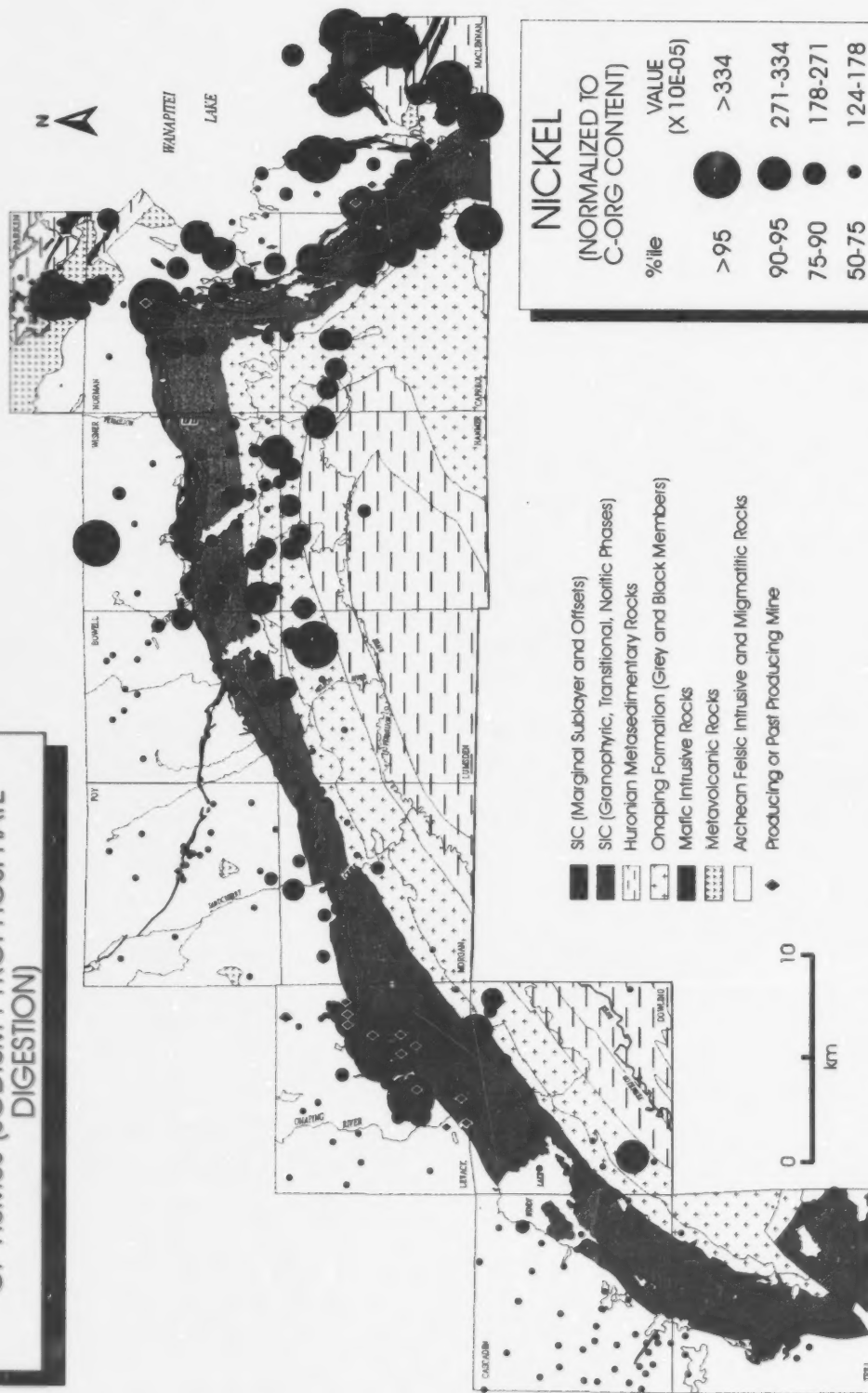


**Appendix E. Regional geochemical plots for humus (Sodium Pyrophosphate  
Digestion)**

NICKEL IN THE <0.177 mm  
FRACTION OF HUMUS  
(SODIUM PYROPHOSPHATE DIGESTION)

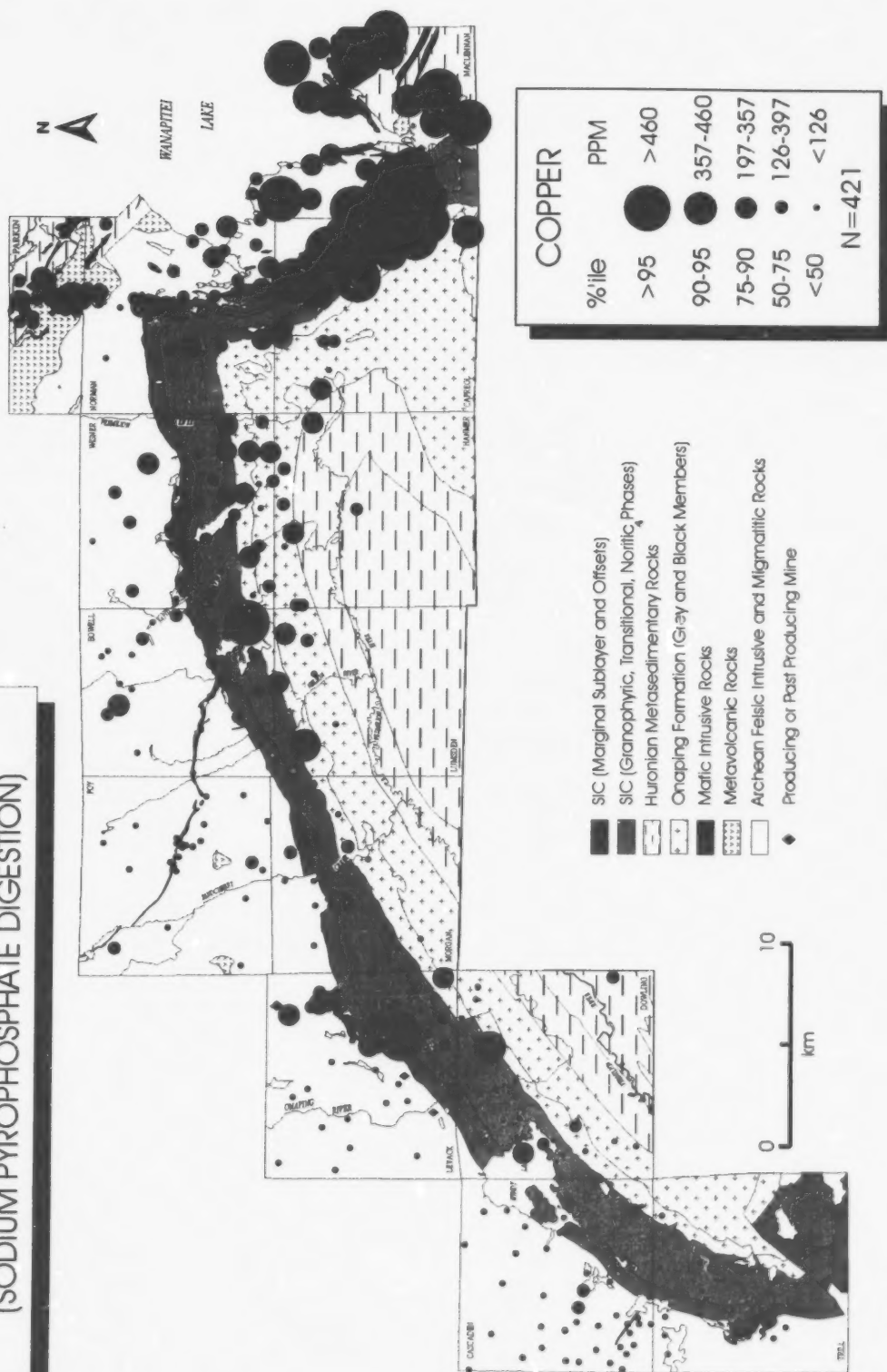


# NICKEL IN THE <0.177 mm FRACTION OF HUMUS (SODIUM PYROPHOSPHATE DIGESTION)



| NICKEL<br>(NORMALIZED TO<br>C-ORG CONTENT) |                     |
|--------------------------------------------|---------------------|
| %ile                                       | VALUE<br>(X 10E-05) |
| >95                                        | >334                |
| 90-95                                      | 271-334             |
| 75-90                                      | 178-271             |
| 50-75                                      | 124-178             |
| <50                                        | <124                |
| N=421                                      |                     |

COPPER IN THE  $<0.177$  mm  
FRACTION OF HUMUS  
(SODIUM PYROPHOSPHATE DIGESTION)

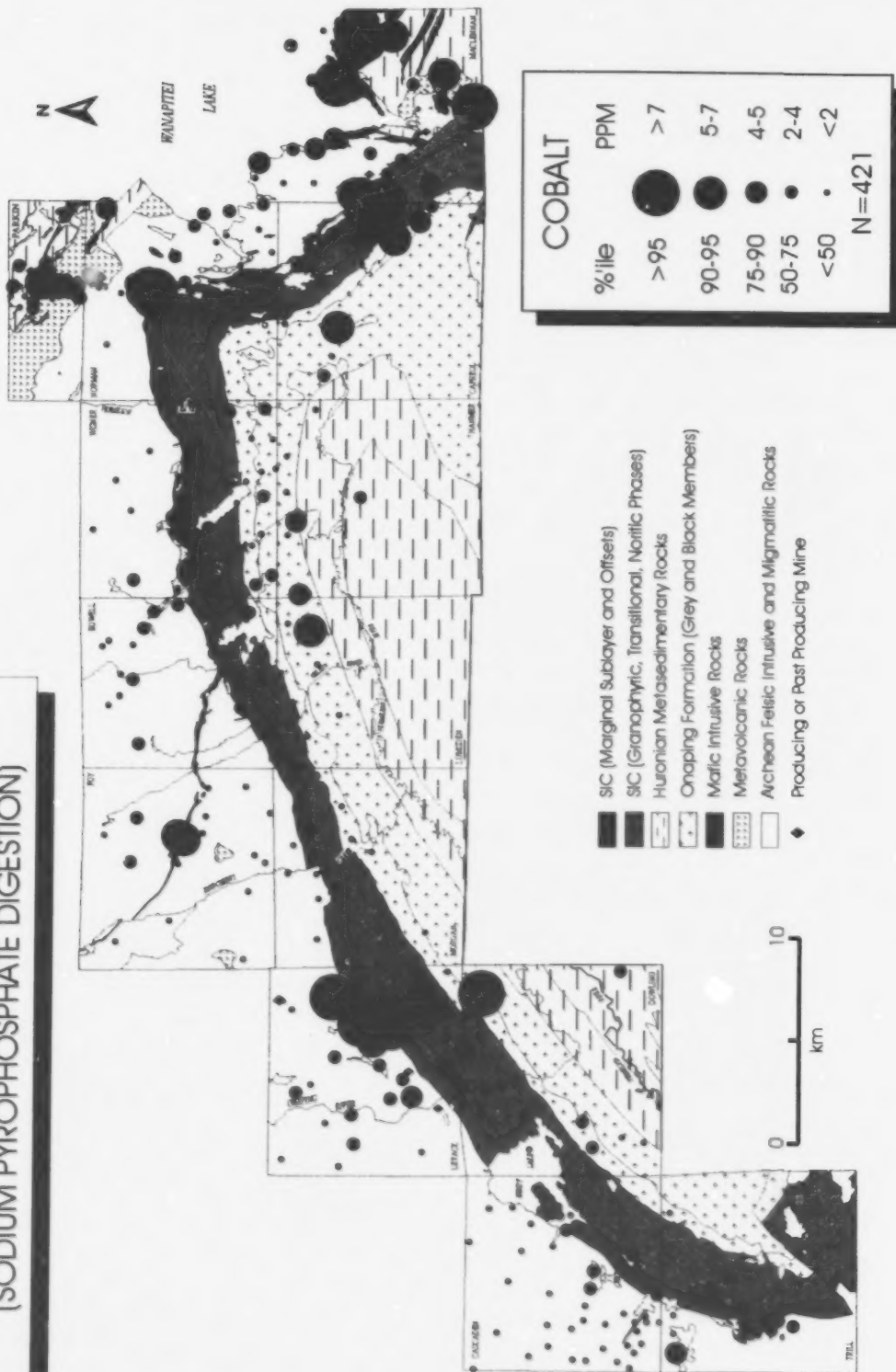


COPPER IN THE  $<0.177$  mm FRACTION  
OF HUMUS (SODIUM PYROPHOSPHATE  
DIGESTION)

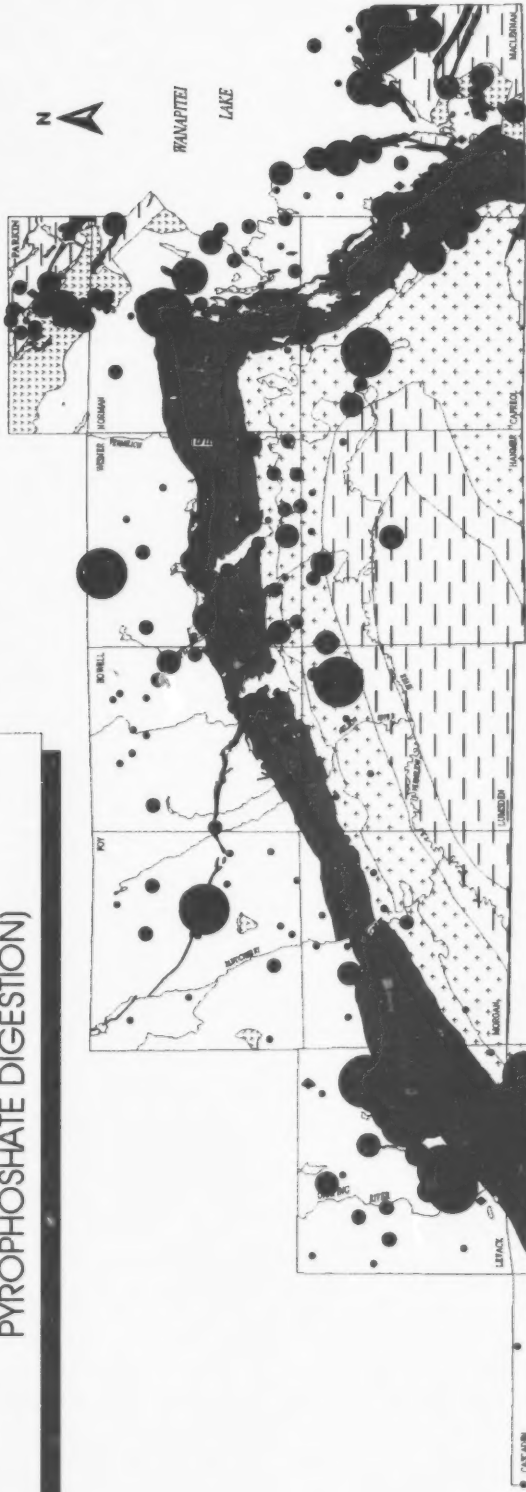




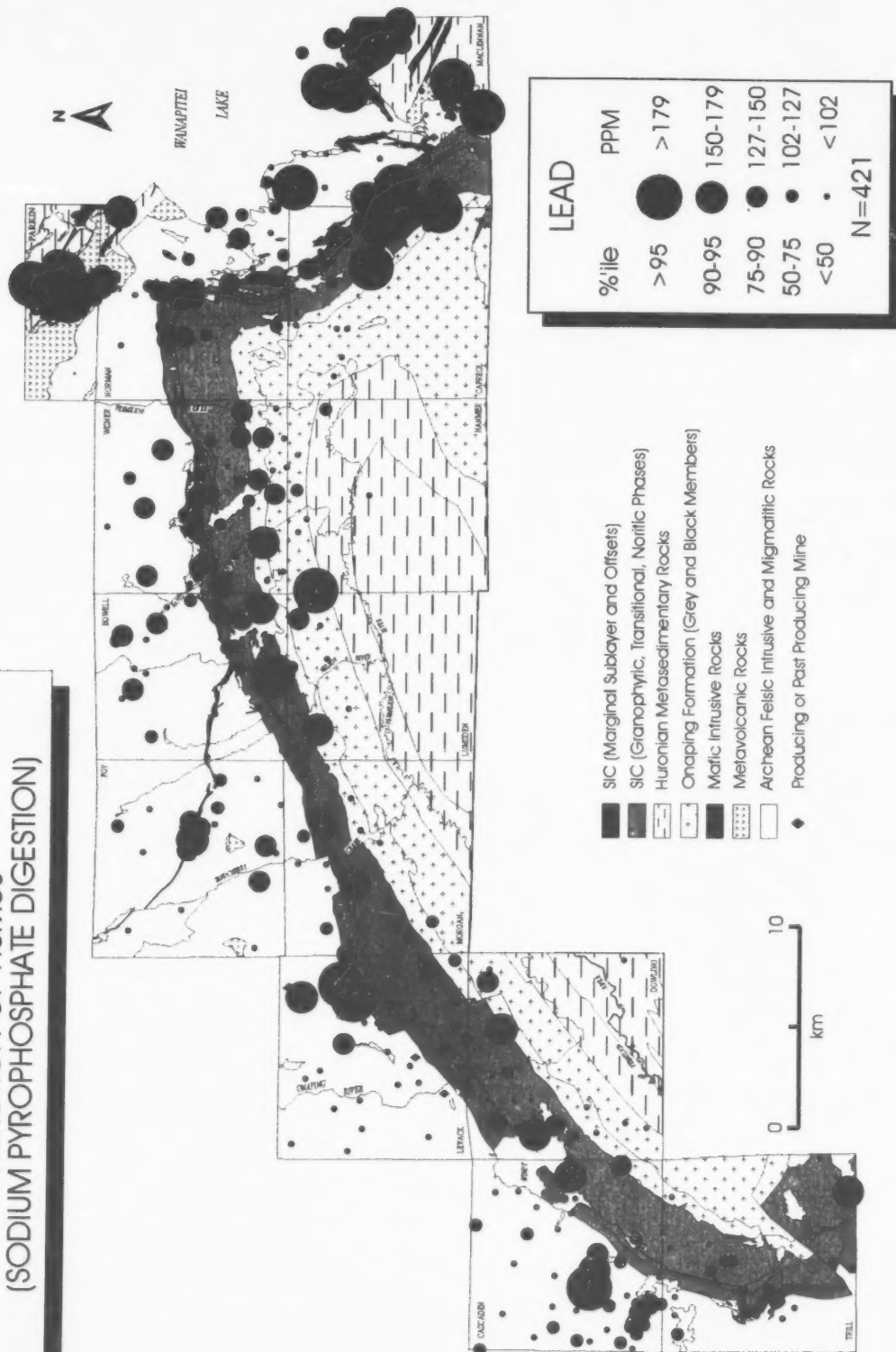
# COBALT IN THE <0.177 mm FRACTION OF HUMUS (SODIUM PYROPHOSPHATE DIGESTION)



COBALT IN THE  $<0.177$   $\mu\text{m}$  FRACTION  
OF HUMUS (SODIUM  
PYROPHOSPHATE DIGESTION)



# LEAD IN THE <0.177 mm FRACTION OF HUMUS (SODIUM PYROPHOSPHATE DIGESTION)



**OF HUMUS (SODIUM PYROPHOSPHATE DIGESTION)**

**LEAD**  
(NORMALIZED TO C-ORG CONTENT)

**%ile**

**VALUE**  
(X 10E-05)

**>95**

**90-95**

**75-90**

**50-75**

**>440**

**394-440**

**324-394**

**253-324**

**Legend:**

- SIC (Marginal Sublayer and Offsets)
- SIC (Girapphyic, Transitional, Nottic Phases)
- Huronian Metasedimentary Rocks
- Onaping Formation (Grey and Black Members)
- Mafic Intrusive Rocks
- Metavolcanic Rocks
- Archean Feisic Intrusive and Migmatitic Rocks
- Producing or Past Producing Mine

**Scale:** 0 10 km

**Inset Map:** Lake Huron

**LEAD**  
(NORMALIZED TO  
C-ORG CONTENT)

| %ile  | VALUE<br>(X 10E-05) |
|-------|---------------------|
| >95   | >440                |
| 90-95 | 394-440             |
| 75-90 | 324-394             |
| 50-75 | 253-324             |
| <50   | <253                |

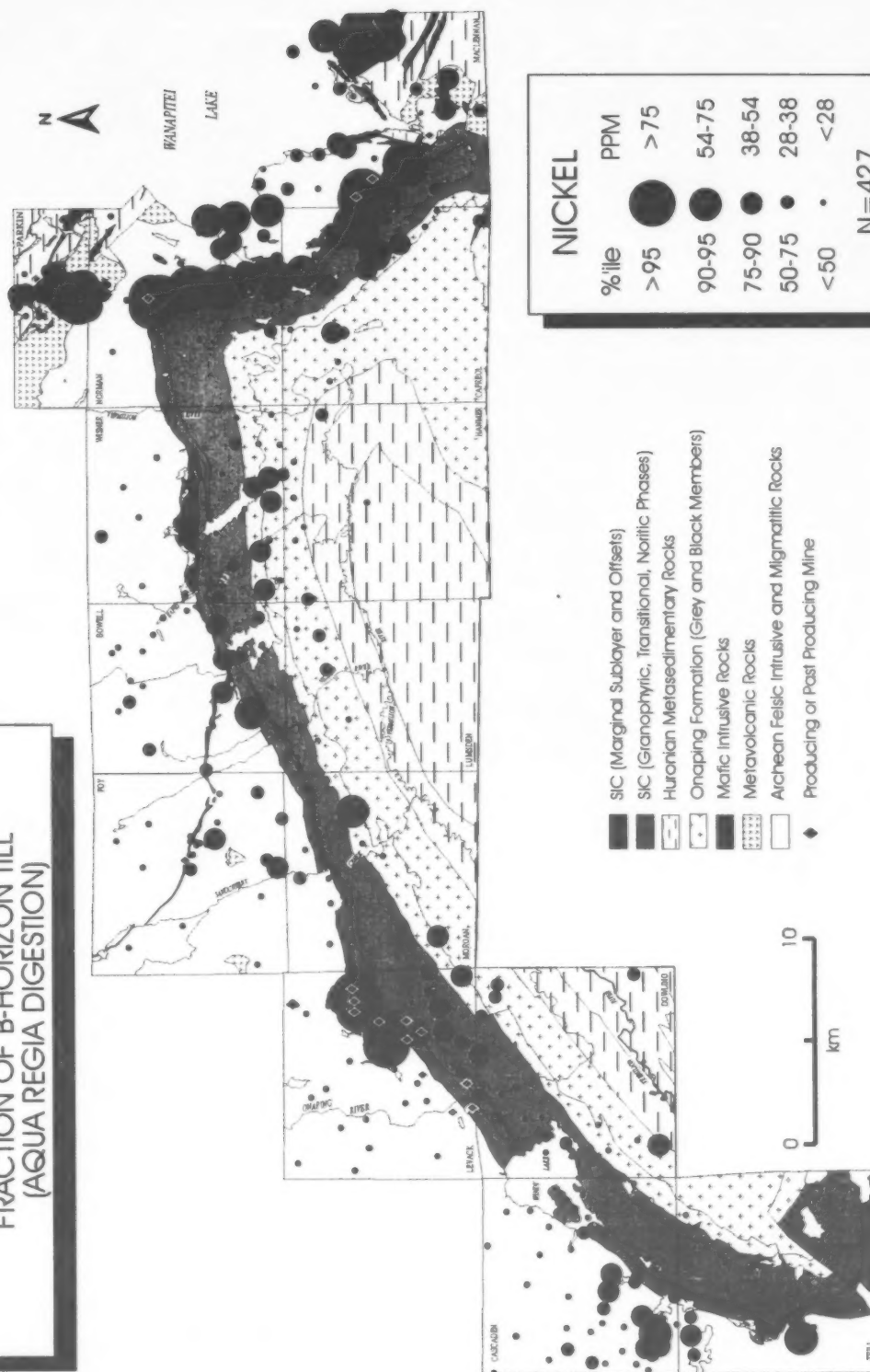
N=421

N=421

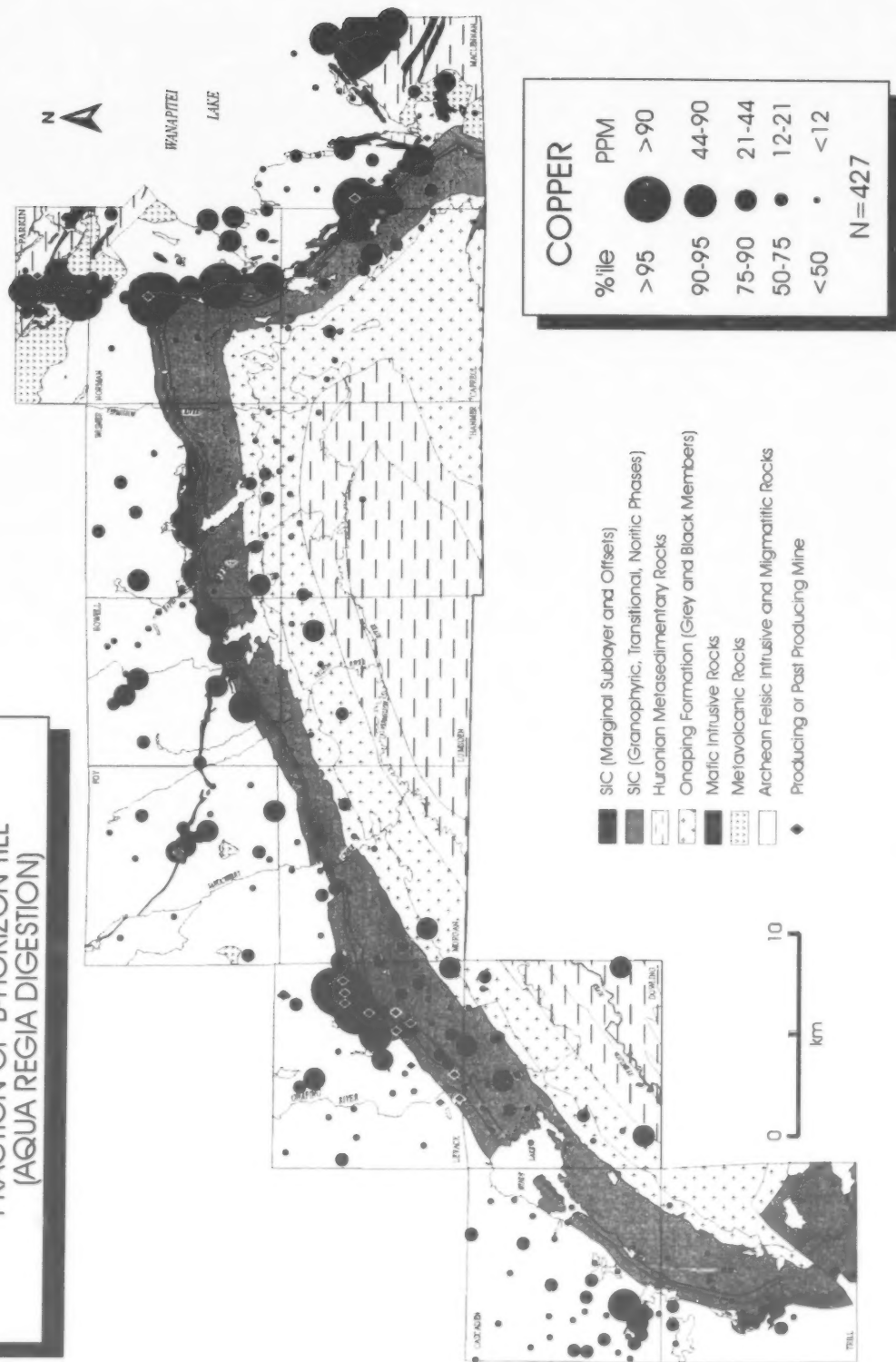
**Appendix F. Regional geochemical plots for B-horizon till (Aqua Regia Digestion)**



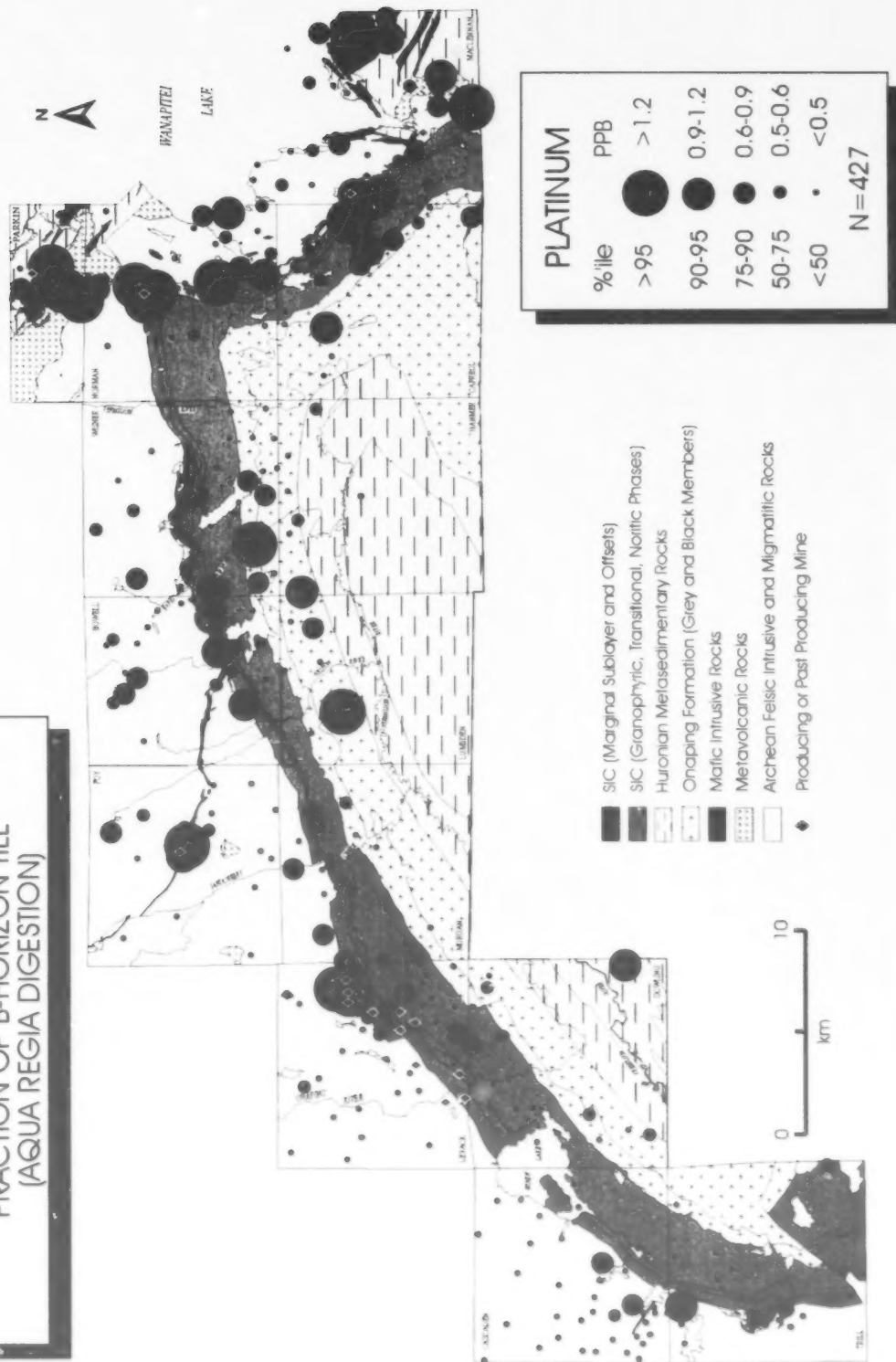
# NICKEL IN THE <63 MICRON FRACTION OF B-HORIZON TILL (AQUA REGIA DIGESTION)



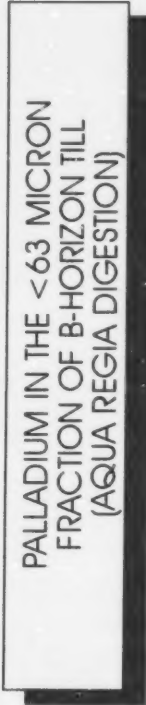
COPPER IN THE <63 MICRON  
FRACTION OF B-HORIZON TILL  
(AQUA REGIA DIGESTION)



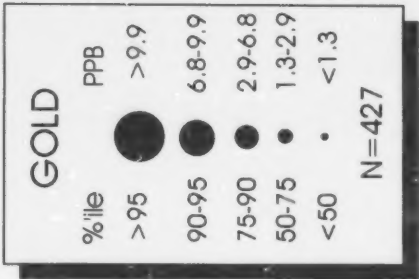
PLATINUM IN THE <63 MICRON  
FRACTION OF B-HORIZON TILL  
(AQUA REGIA DIGESTION)



PALLADIUM IN THE <63 MICRON  
FRACTION OF B-HORIZON TILL  
(AQUA REGIA DIGESTION)

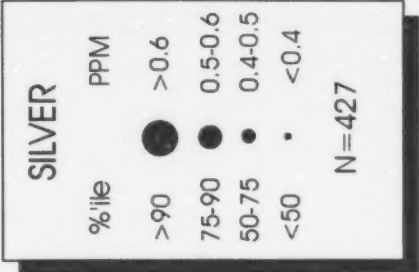


GOLD IN THE <63 MICRON  
FRACTION OF B-HORIZON TILL  
(AQUA REGIA DIGESTION)

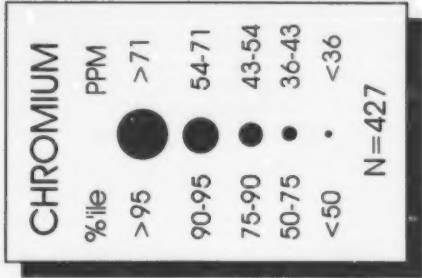




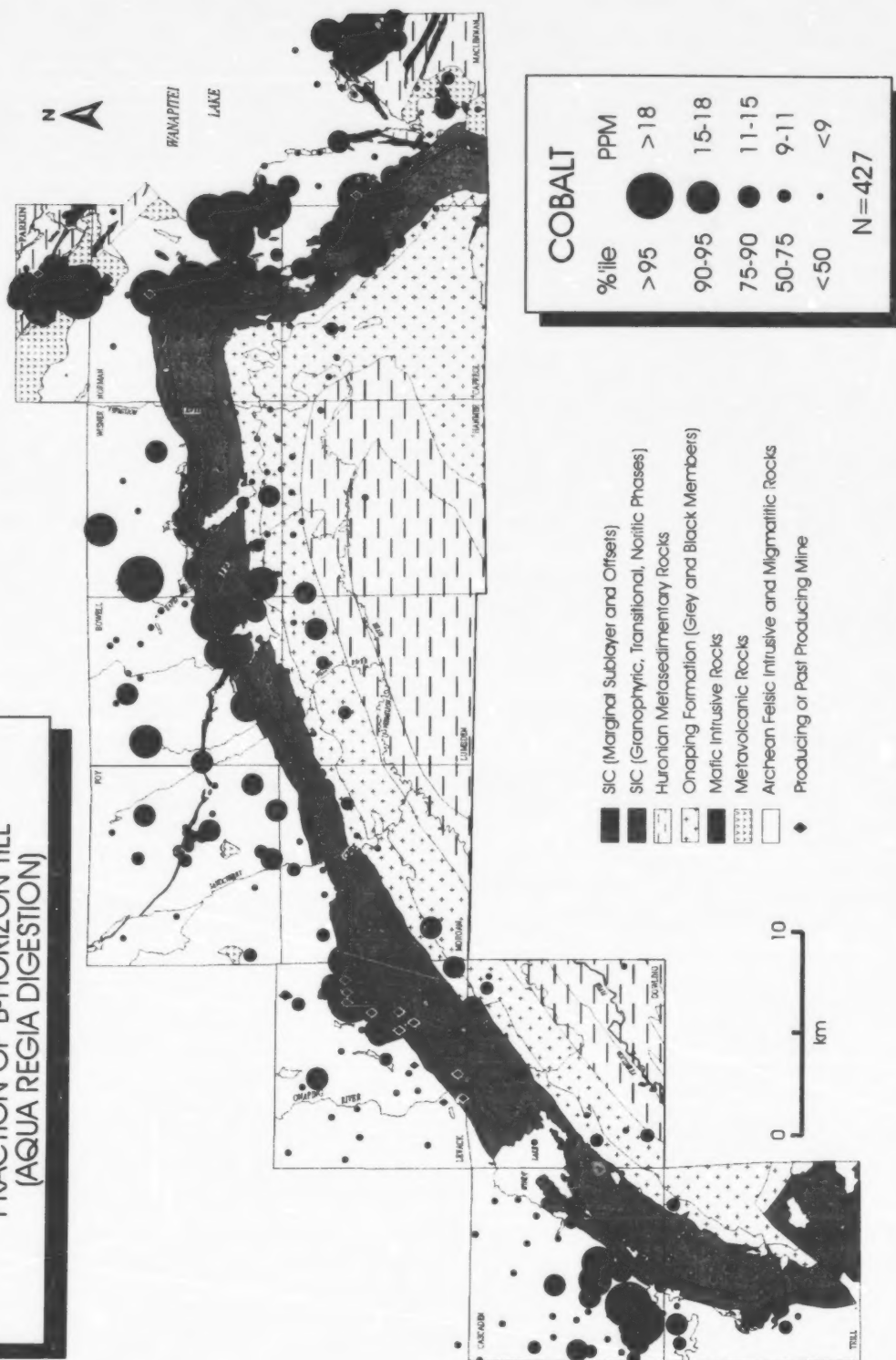
SILVER IN THE <63 MICRON  
FRACTION OF B-HORIZON TILL  
(AQUA REGIA DIGESTION)



CHROMIUM IN THE <63 MICRON  
FRACTION OF B-HORIZON TILL  
(AQUA REGIA DIGESTION)



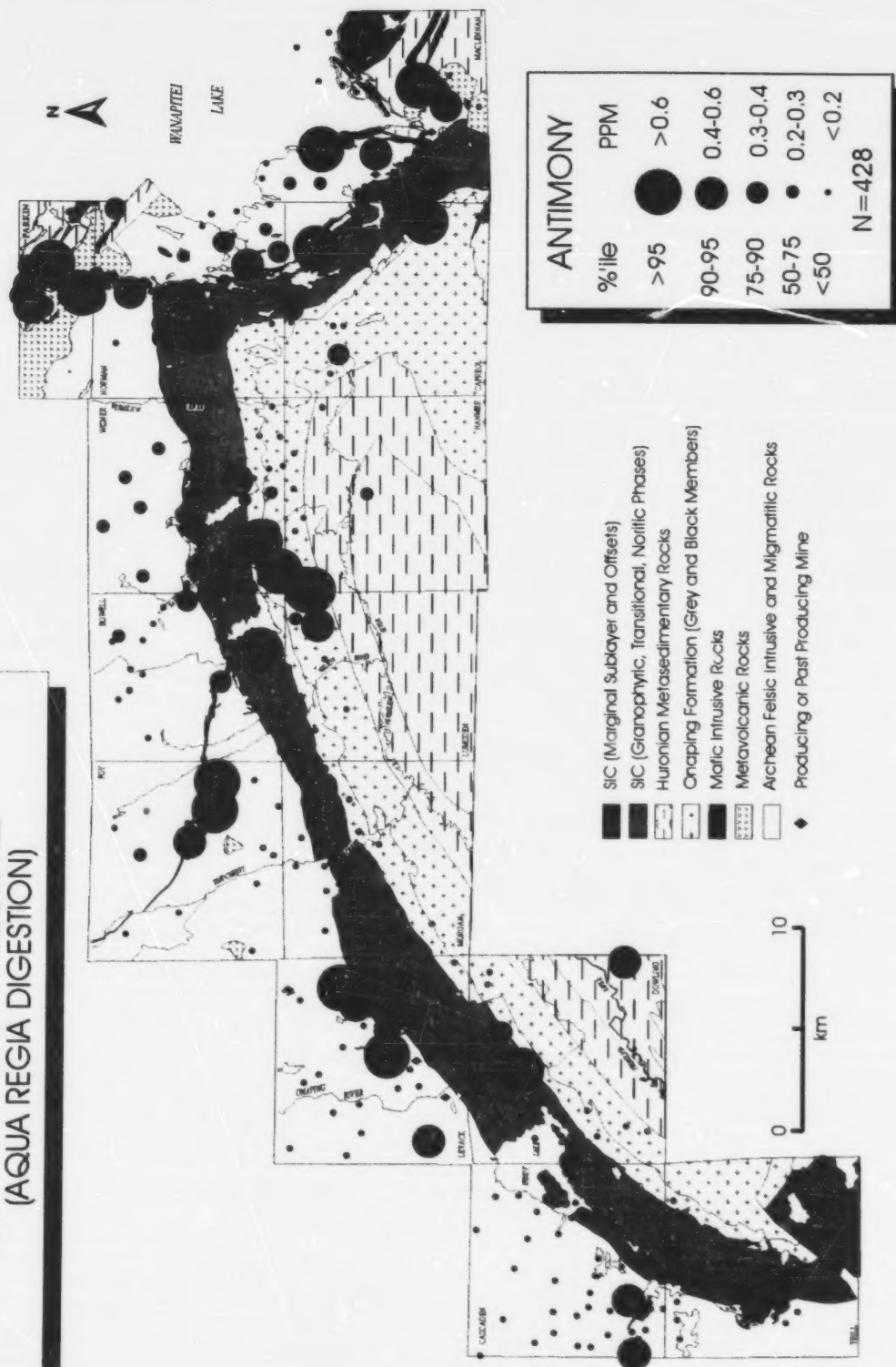
COBALT IN THE <63 MICRON  
FRACTION OF B-HORIZON TILL  
(AQUA REGIA DIGESTION)



ARSENIC IN THE <63 MICRON  
FRACTION OF B-HORIZON TILL  
(AQUA REGIA DIGESTION)

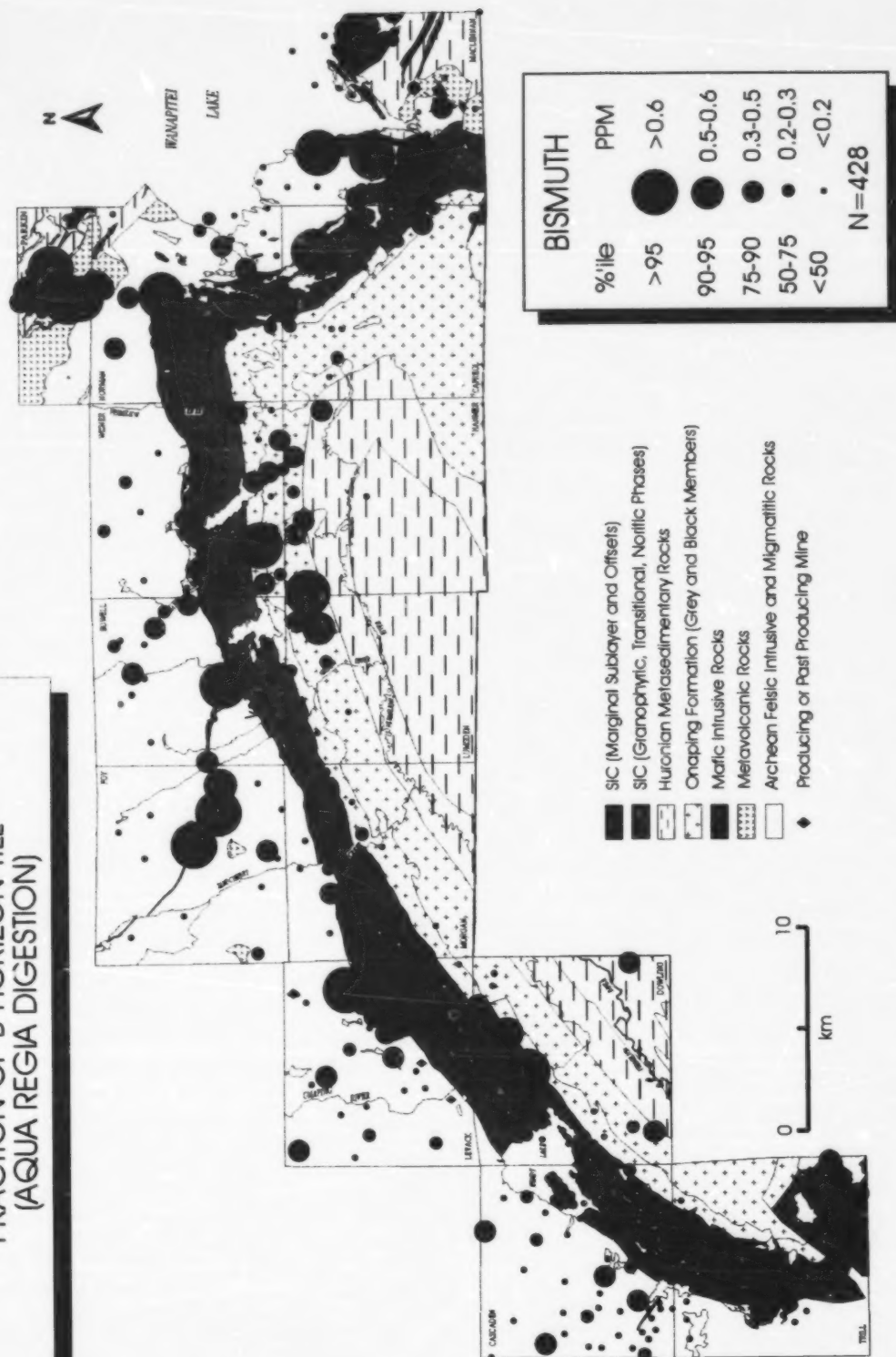


# ANTIMONY IN THE <63 MICRON FRACTION OF B-HORIZON TILL (AQUA REGIA DIGESTION)

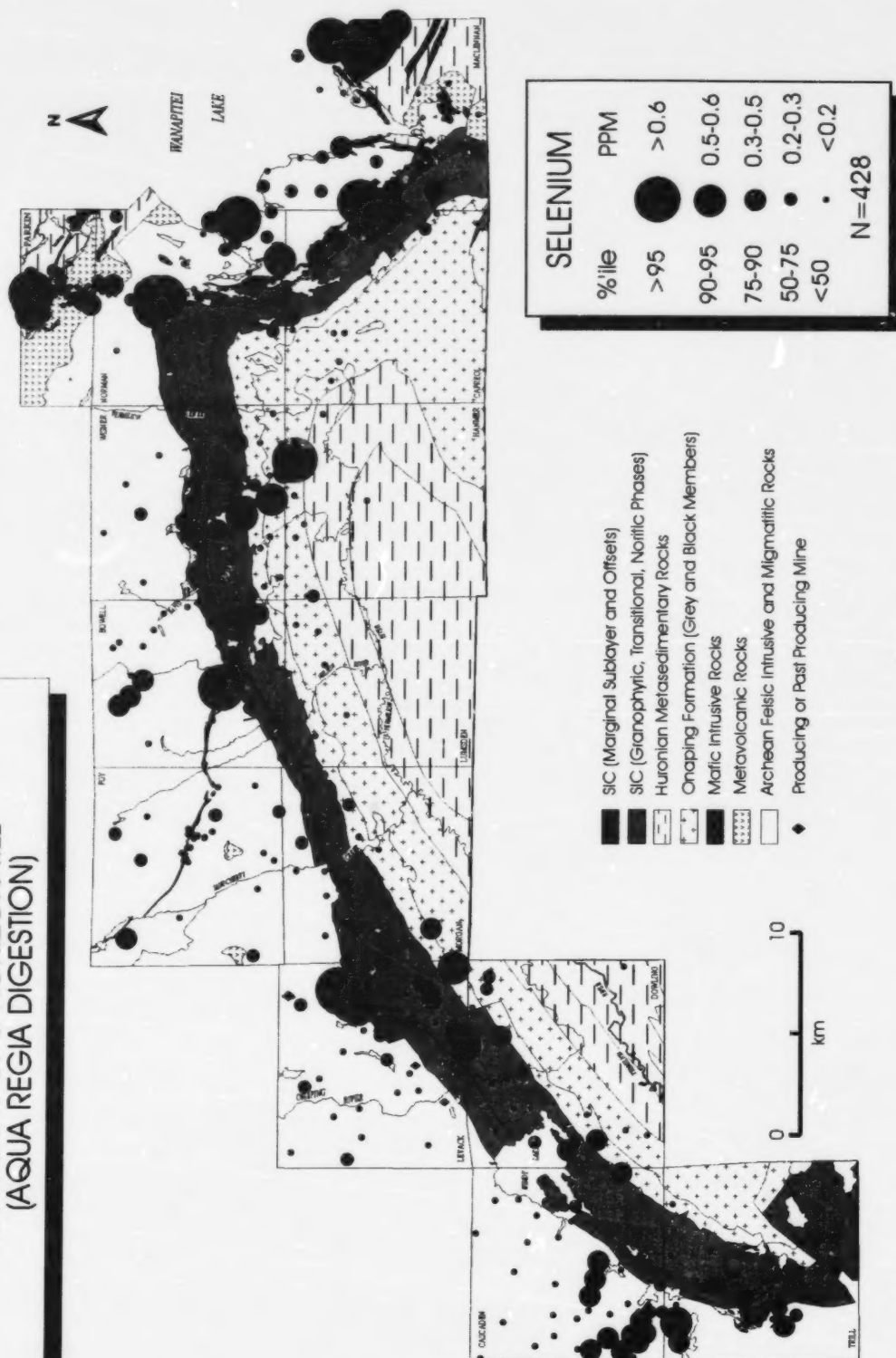




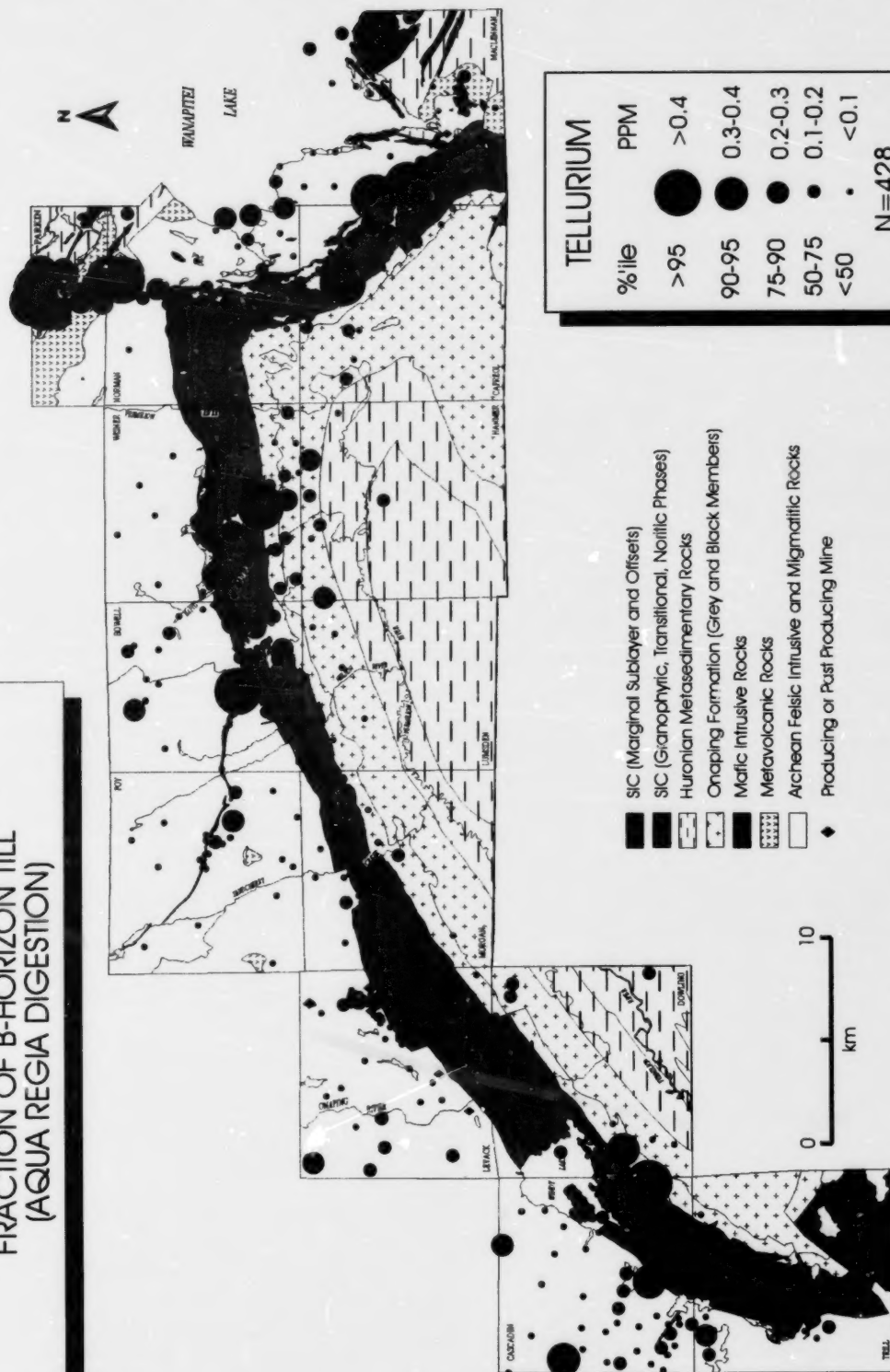
**BISMUTH IN THE <63 MICRON  
FRACTION OF B-HORIZON TILL  
(AQUA REGIA DIGESTION)**



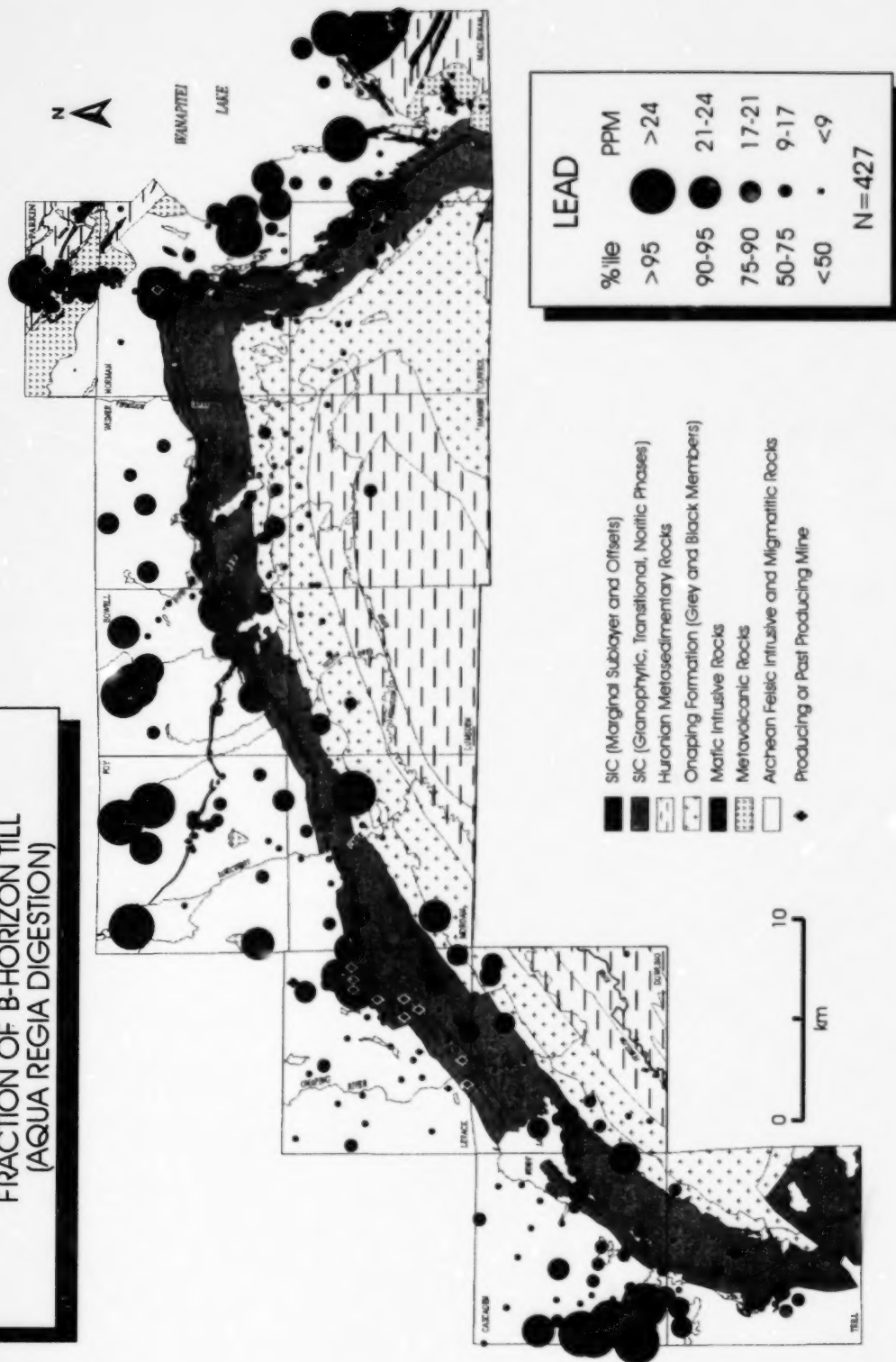
# SELENIUM IN THE <63 MICRON FRACTION OF B-HORIZON TILL (AQUA REGIA DIGESTION)



# TELLURIUM IN THE <63 MICRON FRACTION OF B-HORIZON TILL (AQUA REGIA DIGESTION)



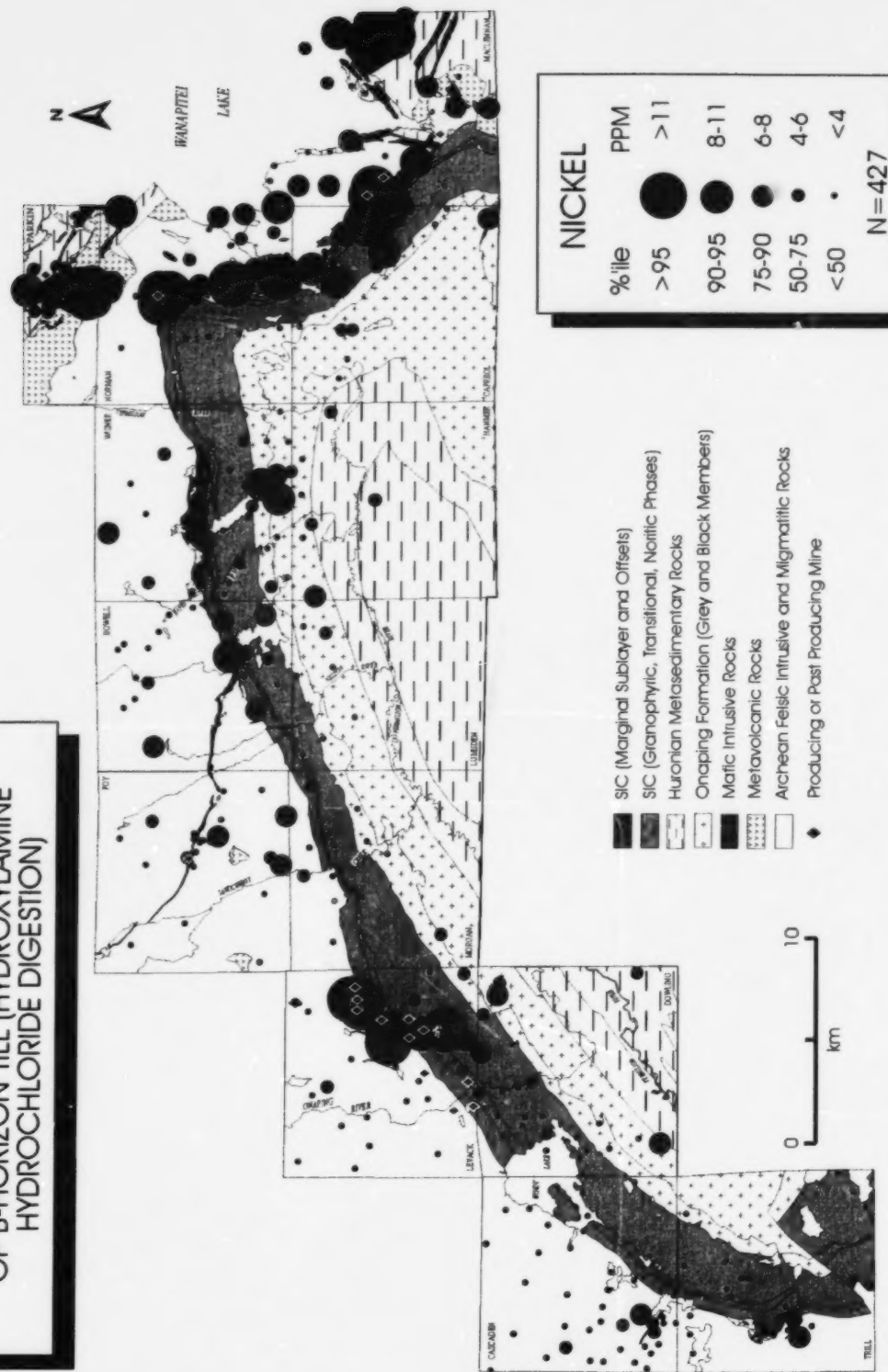
# LEAD IN THE <63 MICRON FRACTION OF B-HORIZON TILL (AQUA REGIA DIGESTION)



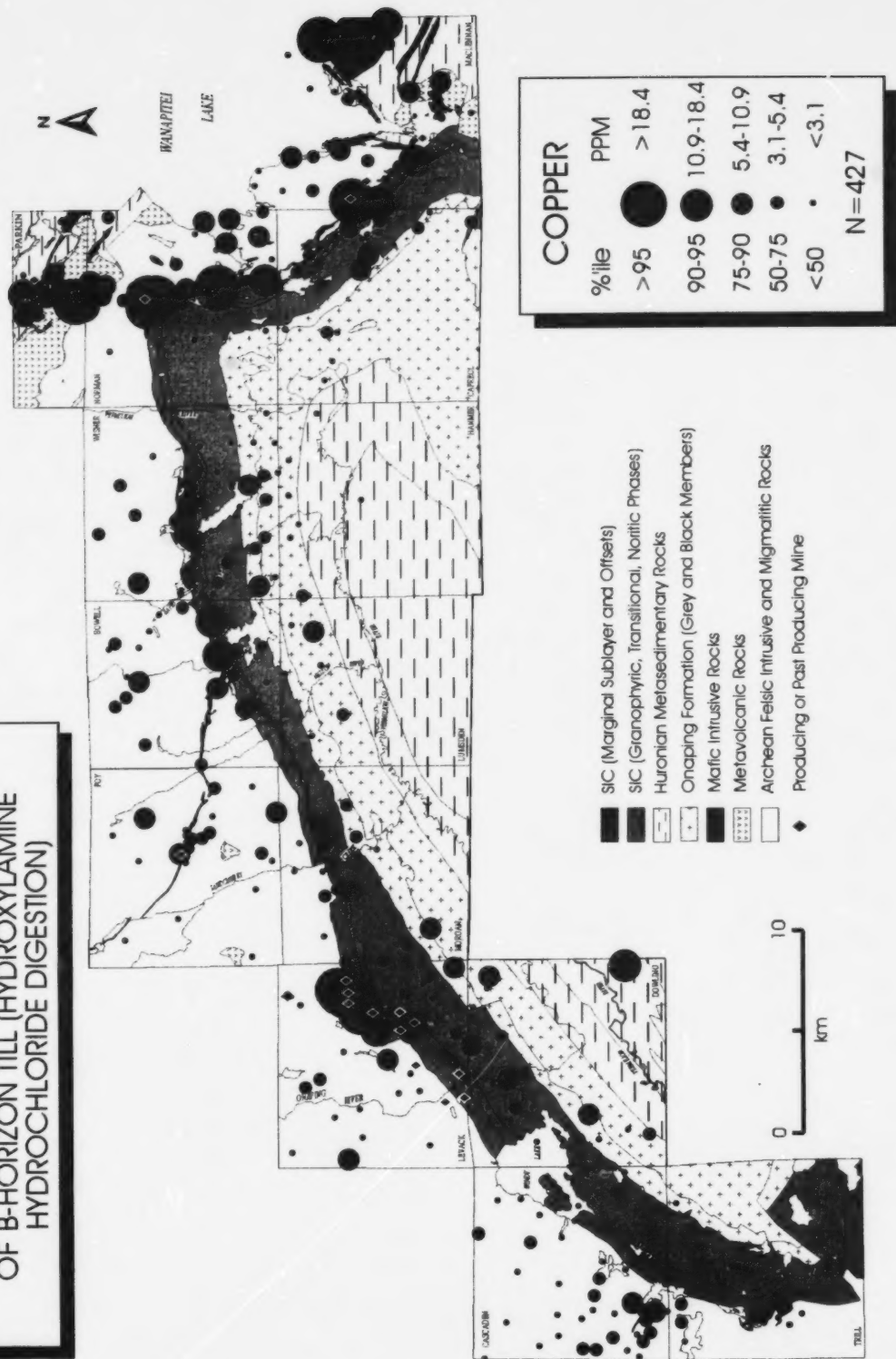
**Appendix G. Regional geochemical plots for B-horizon till (Hydroxylamine  
Hydrochloride Digestion)**



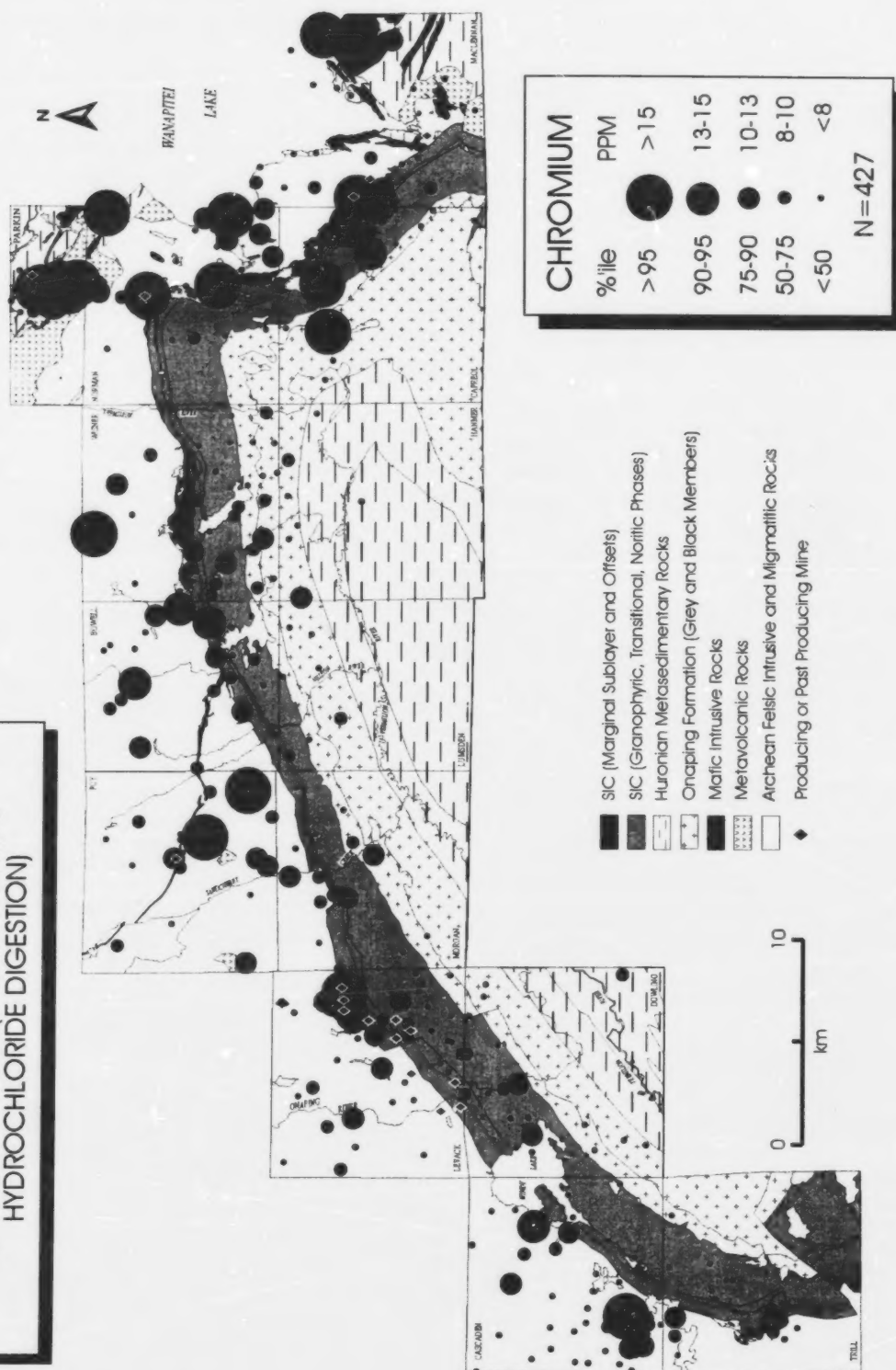
# NICKEL IN THE <63 MICRON FRACTION OF B-HORIZON TILL (HYDROXYLAMINE HYDROCHLORIDE DIGESTION)



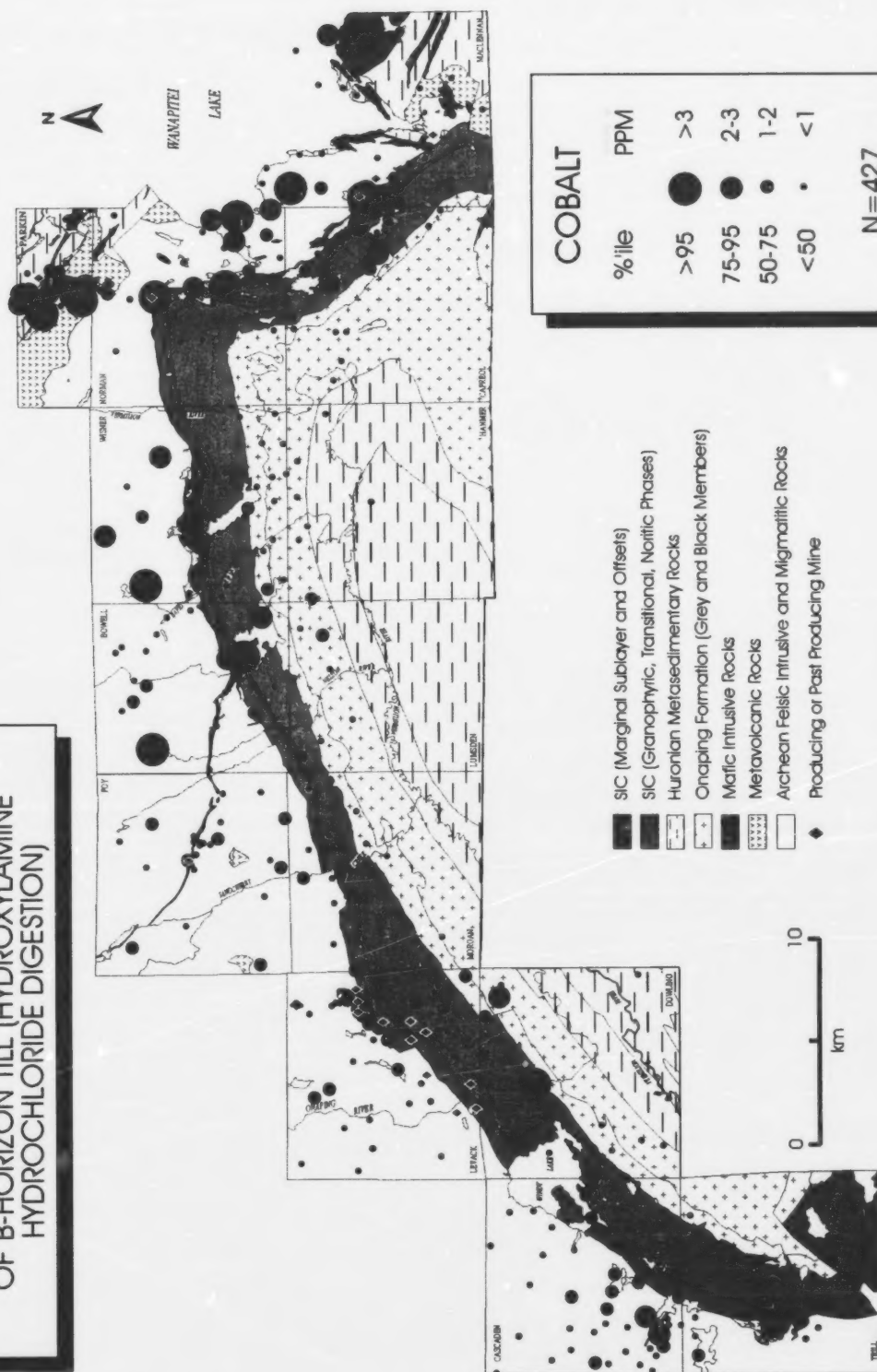
COPPER IN THE <63 MICRON FRACTION  
OF B-HORIZON TILL (HYDROXYLAMINE  
HYDROCHLORIDE DIGESTION)



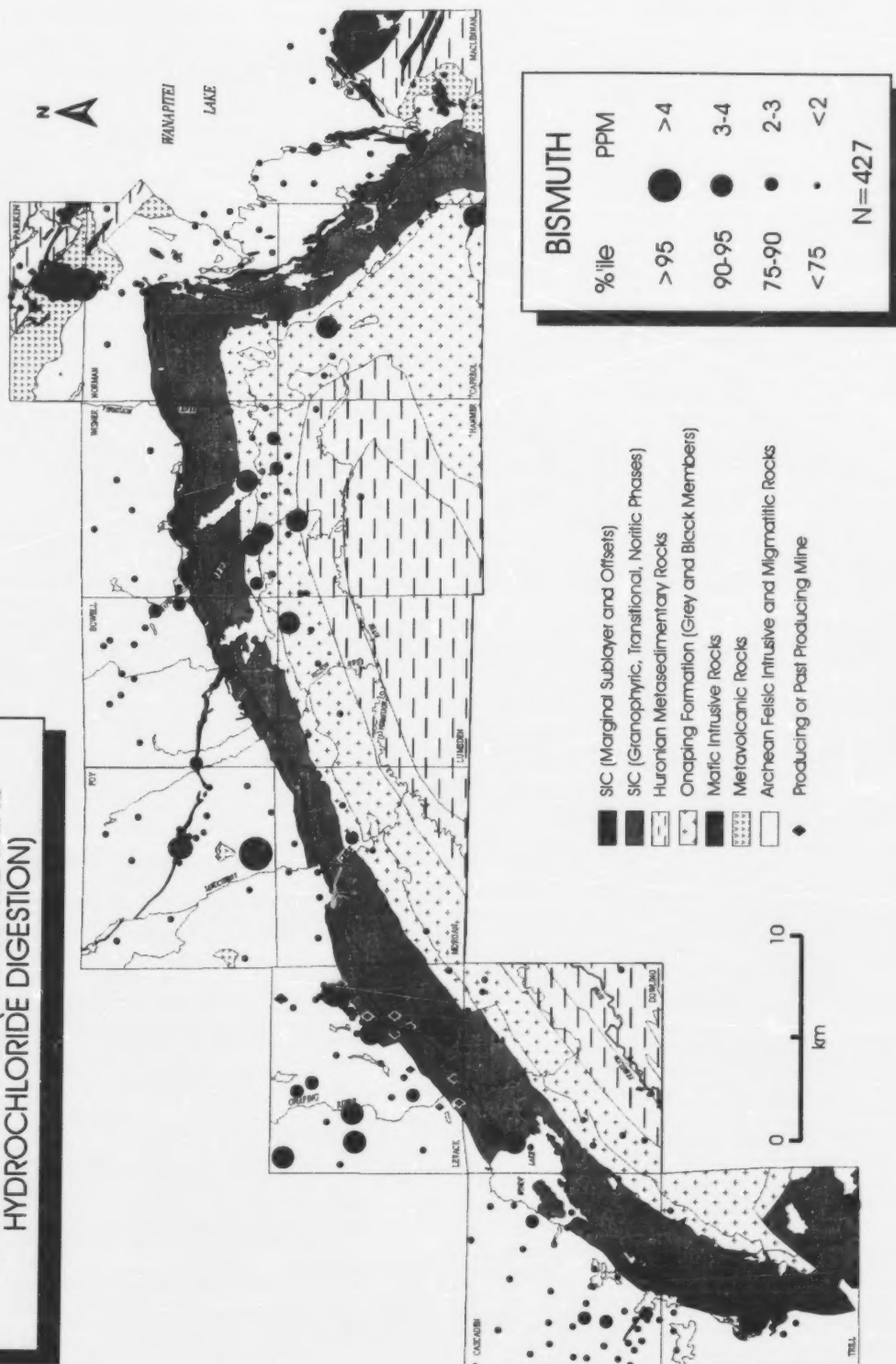
# CHROMIUM IN THE <63 MICRON FRACTION OF B-HORIZON TILL (HYDROXYLAMINE HYDROCHLORIDE DIGESTION)



COBALT IN THE <63 MICRON FRACTION  
OF B-HORIZON TILL (HYDROXYLAMINE  
HYDROCHLORIDE DIGESTION)

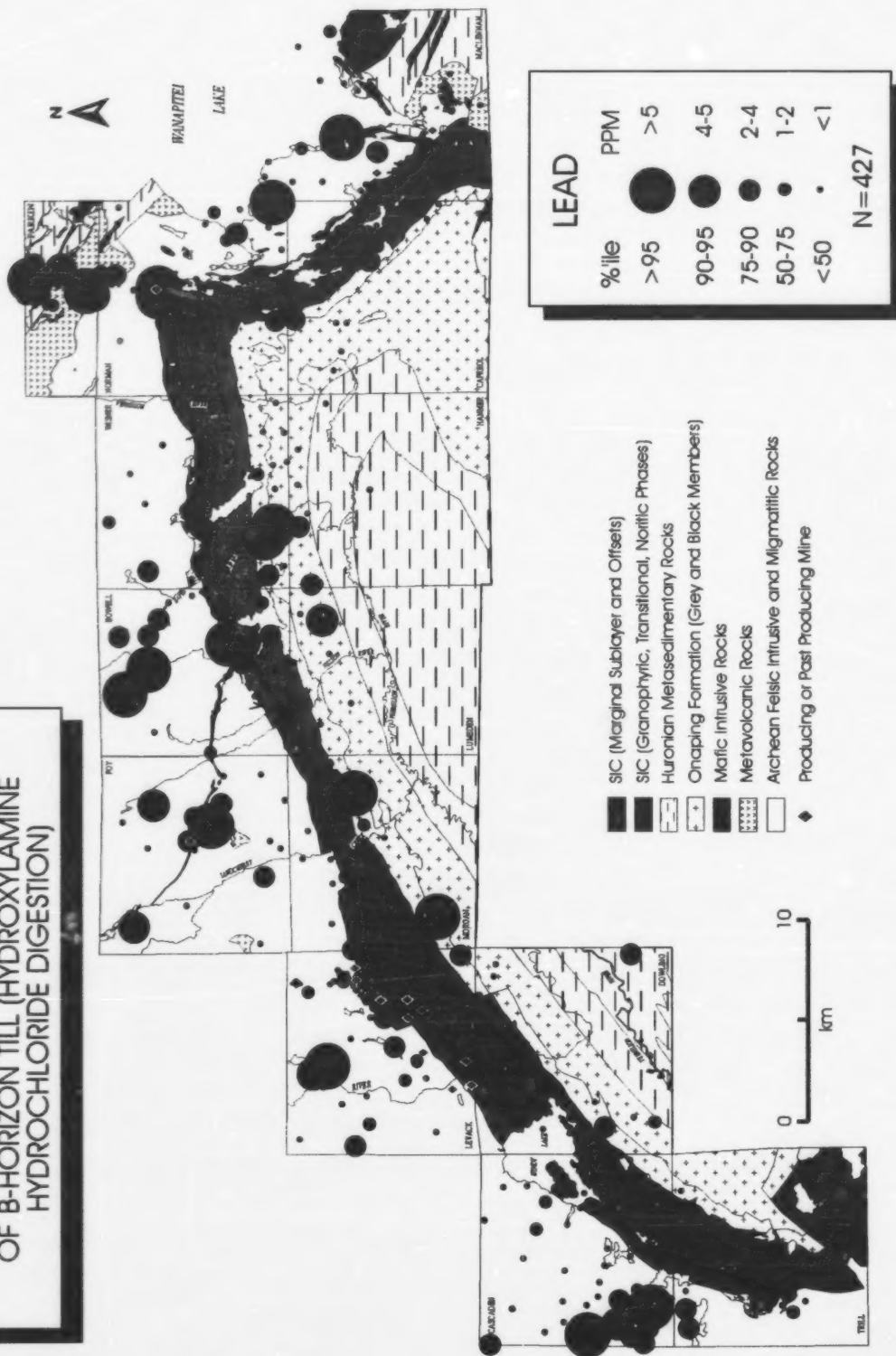


# BISMUTH IN THE <63 MICRON FRACTION OF B-HORIZON TILL (HYDROXYLAMINE HYDROCHLORIDE DIGESTION)



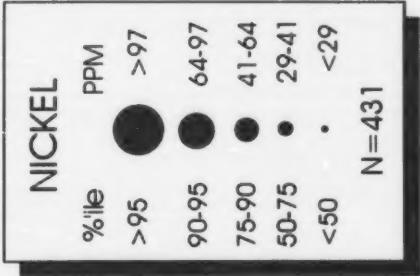


LEAD IN THE <63 MICRON FRACTION  
OF B-HORIZON TILL (HYDROXYLAMINE  
HYDROCHLORIDE DIGESTION)

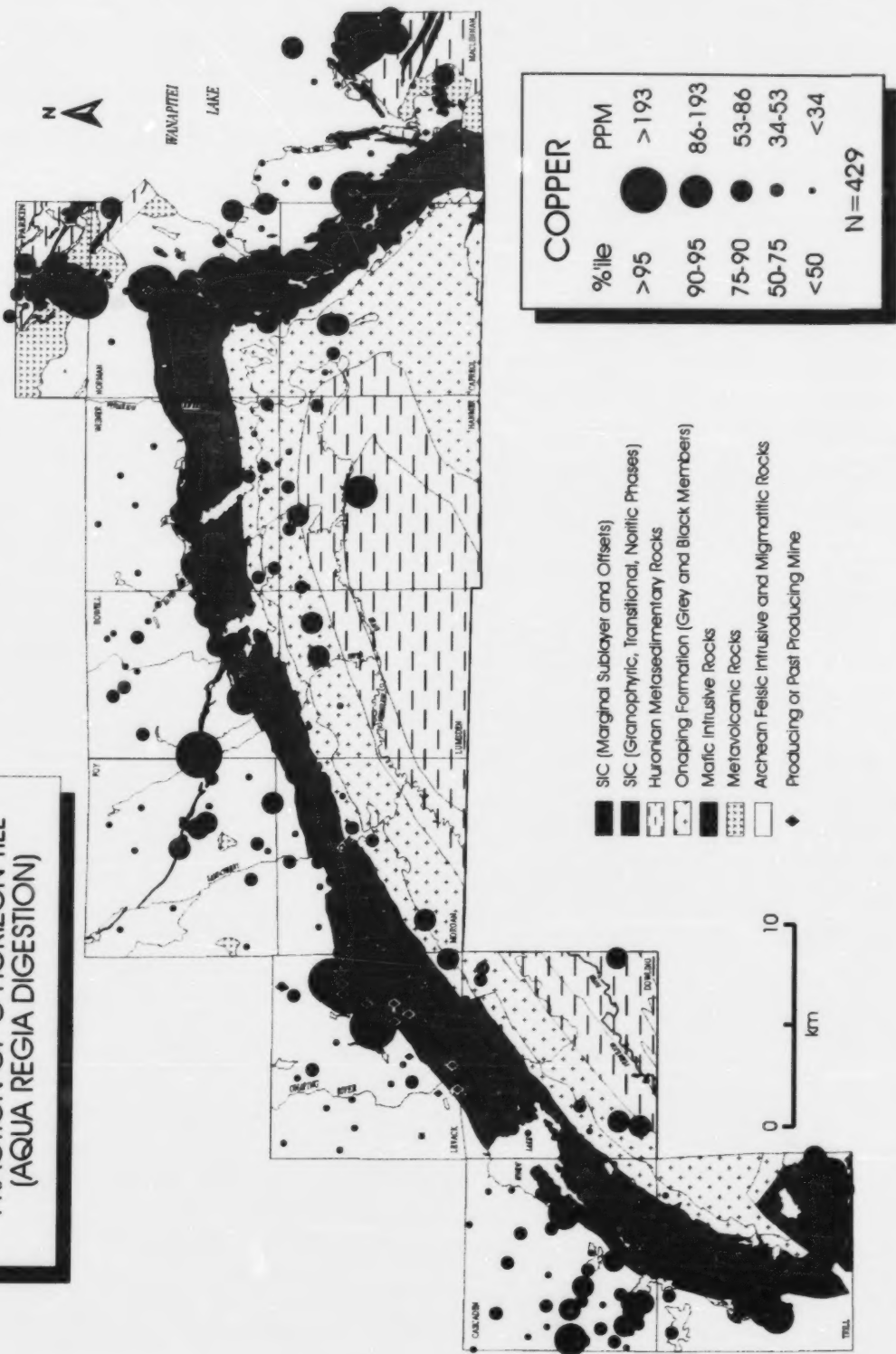


**Appendix H. Regional geochemical plots for C-horizon till (Aqua Regia Digestion)**

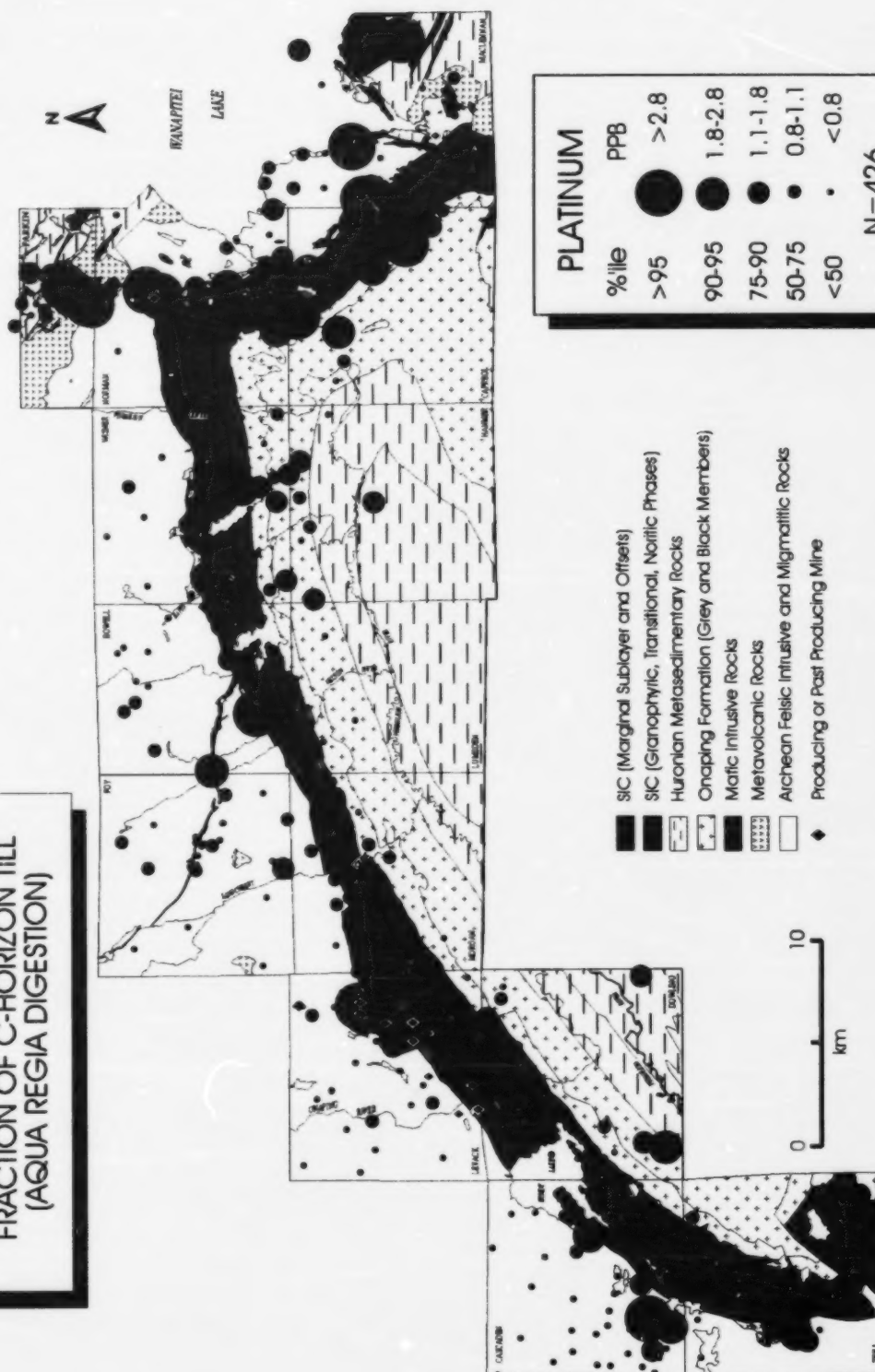
NICKEL IN THE <63 MICRON  
FRACTION OF C-HORIZON TILL  
(AQUA REGIA DIGESTION)



COPPER IN THE <63 MICRON  
FRACTION OF C-HORIZON TILL  
(AQUA REGIA DIGESTION)

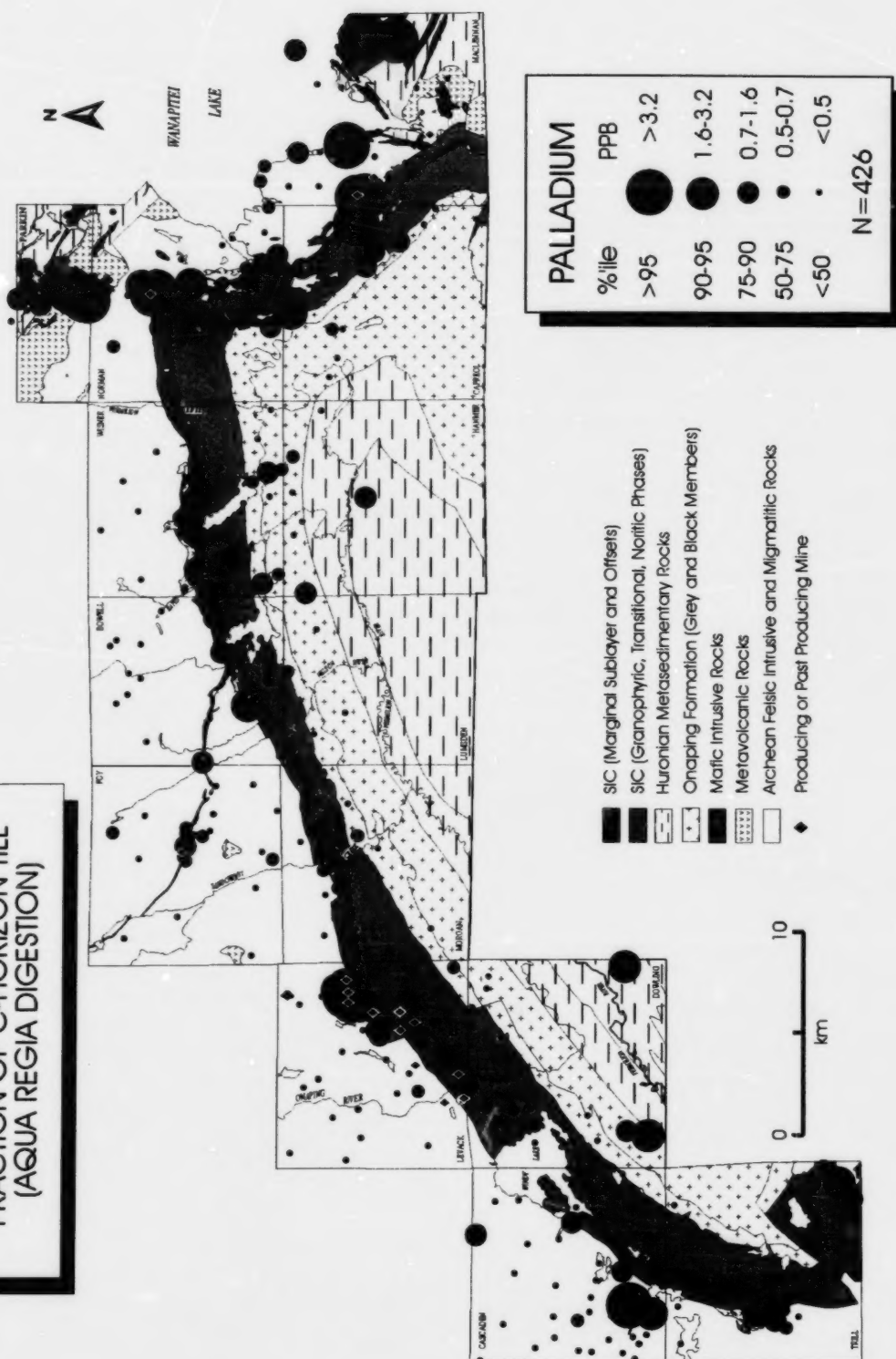


PLATINUM IN THE <63 MICRON  
FRACTION OF C-HORIZON TILL  
(AQUA REGIA DIGESTION)

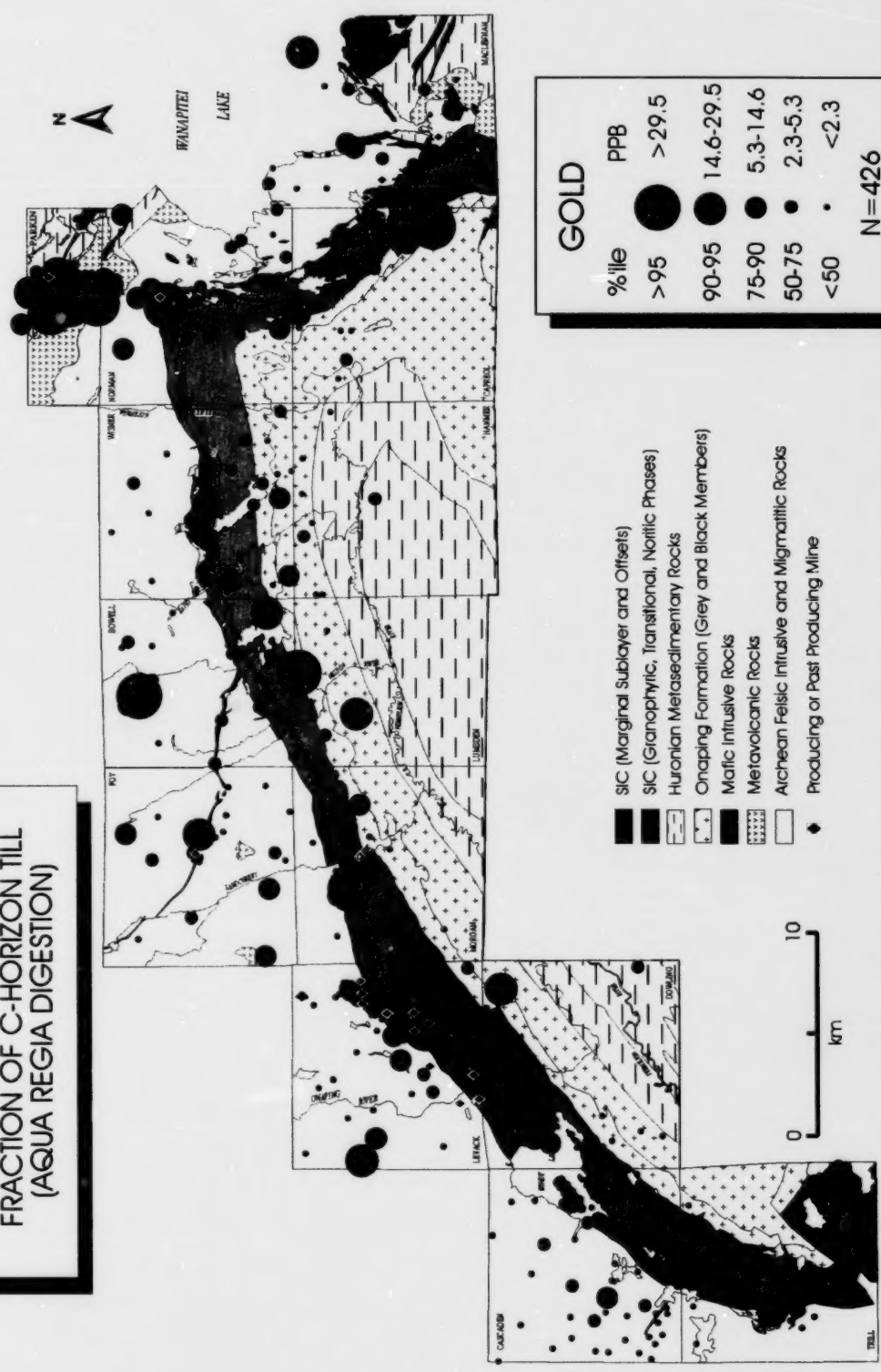




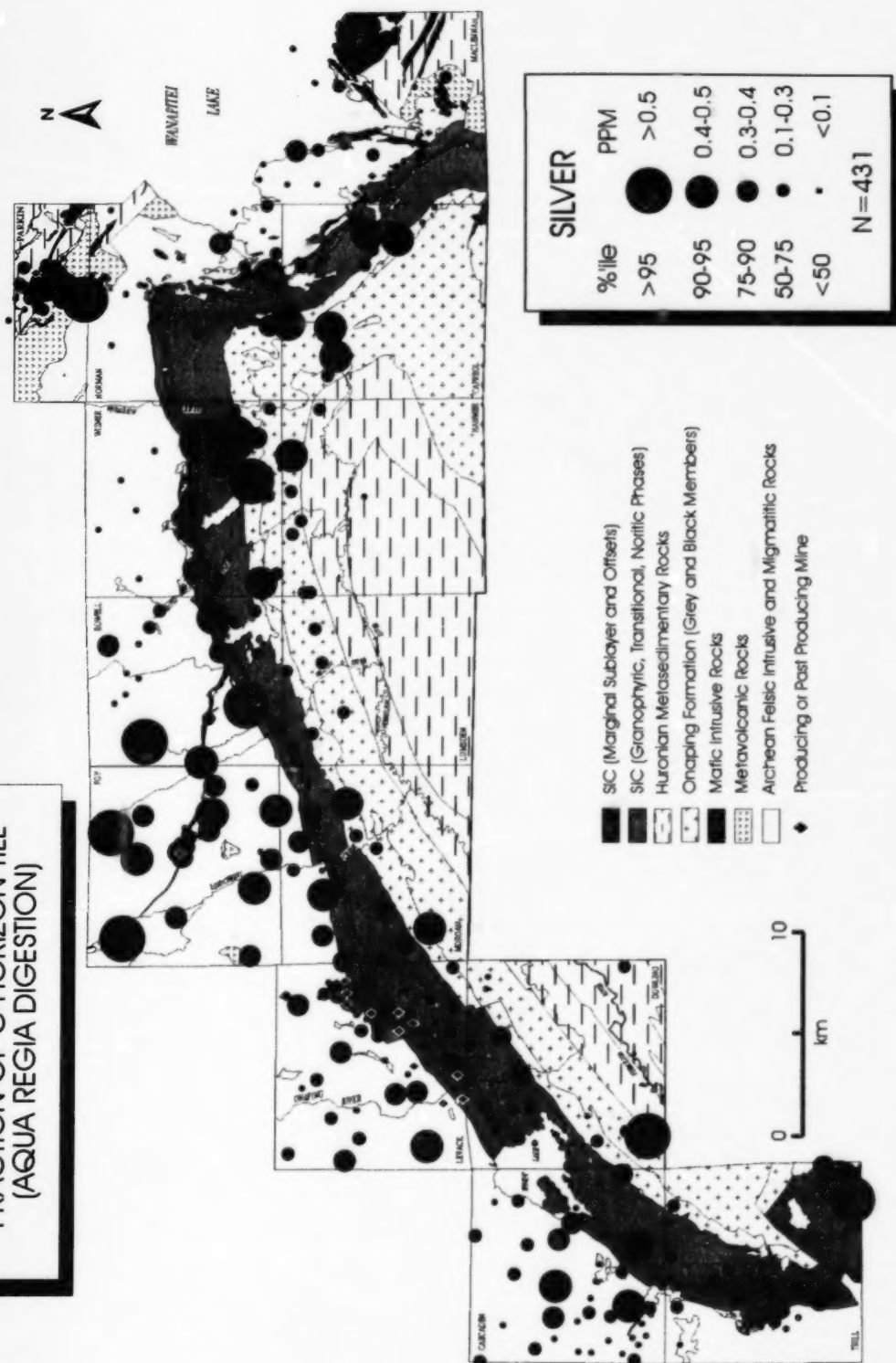
PALLADIUM IN THE <63 MICRON  
FRACTION OF C-HORIZON TILL  
(AQUA REGIA DIGESTION)



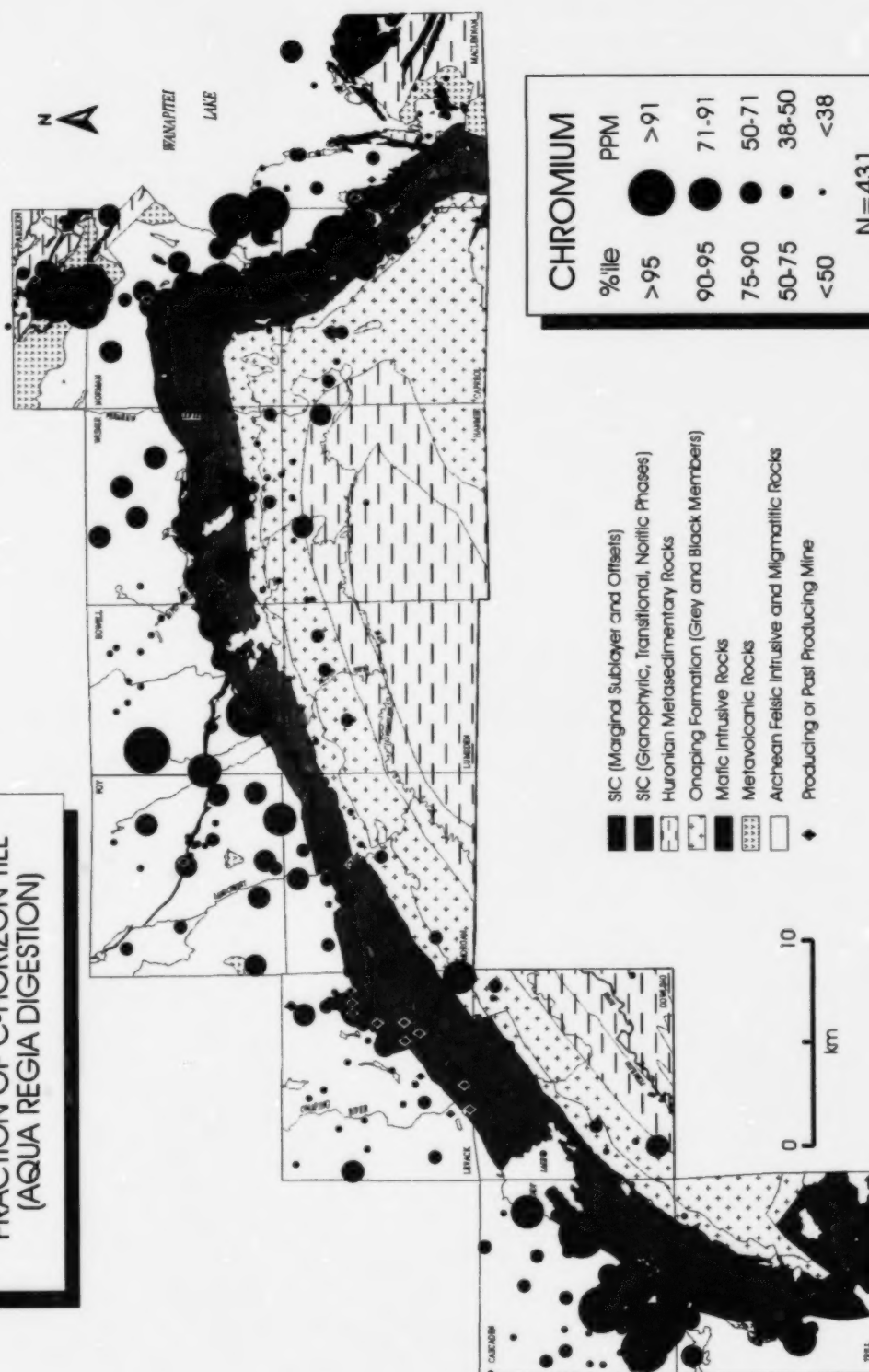
GOLD IN THE <63 MICRON  
FRACTION OF C-HORIZON TILL  
(AQUA REGIA DIGESTION)



**SILVER IN THE <63 MICRON  
FRACTION OF C-HORIZON TILL  
(AQUA REGIA DIGESTION)**



CHROMIUM IN THE <63 MICRON  
FRACTION OF C-HORIZON TILL  
(AQUA REGIA DIGESTION)

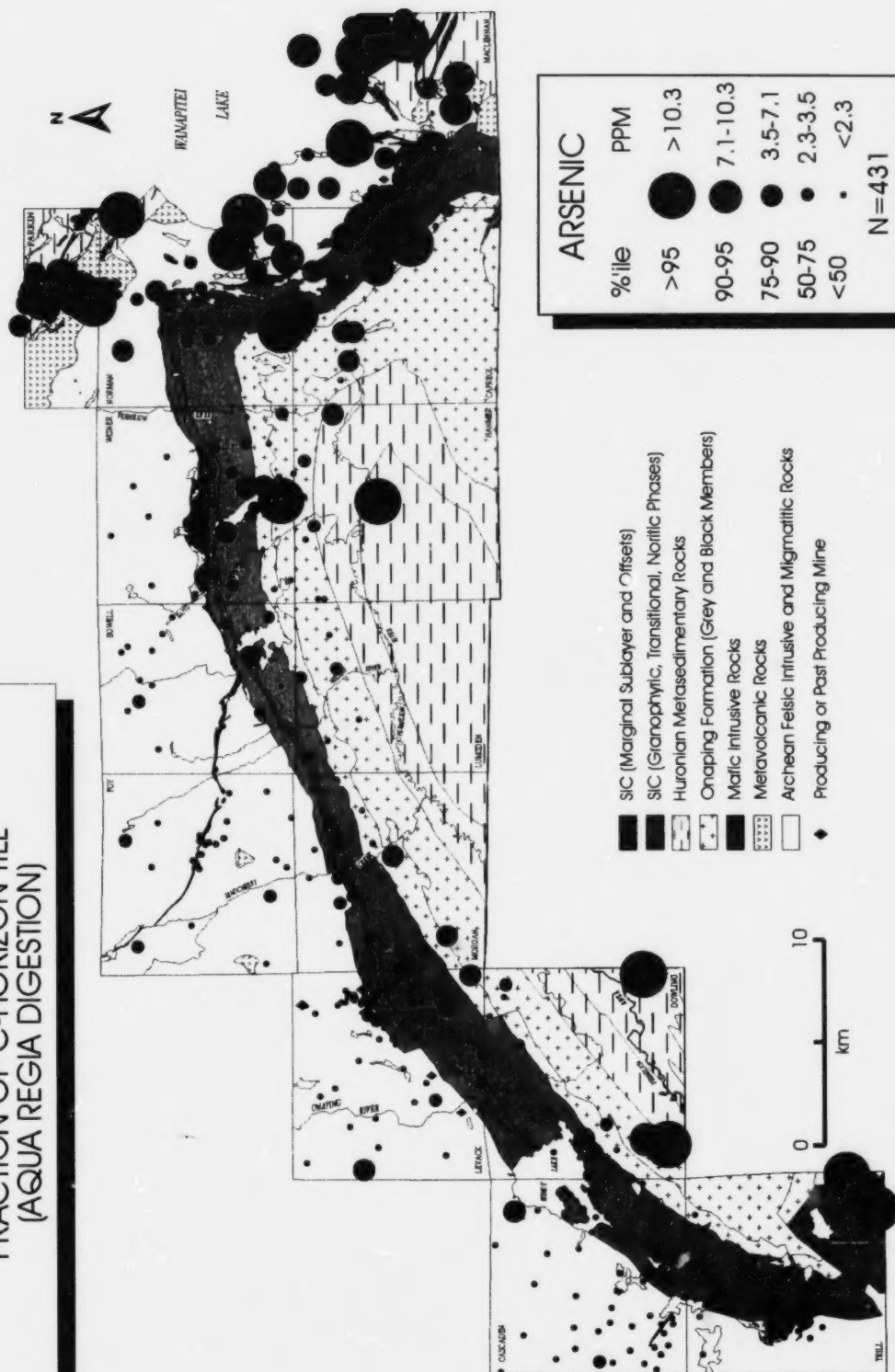


COBALT IN THE <63 MICRON  
FRACTION OF C-HORIZON TILL  
(AQUA REGIA DIGESTION)

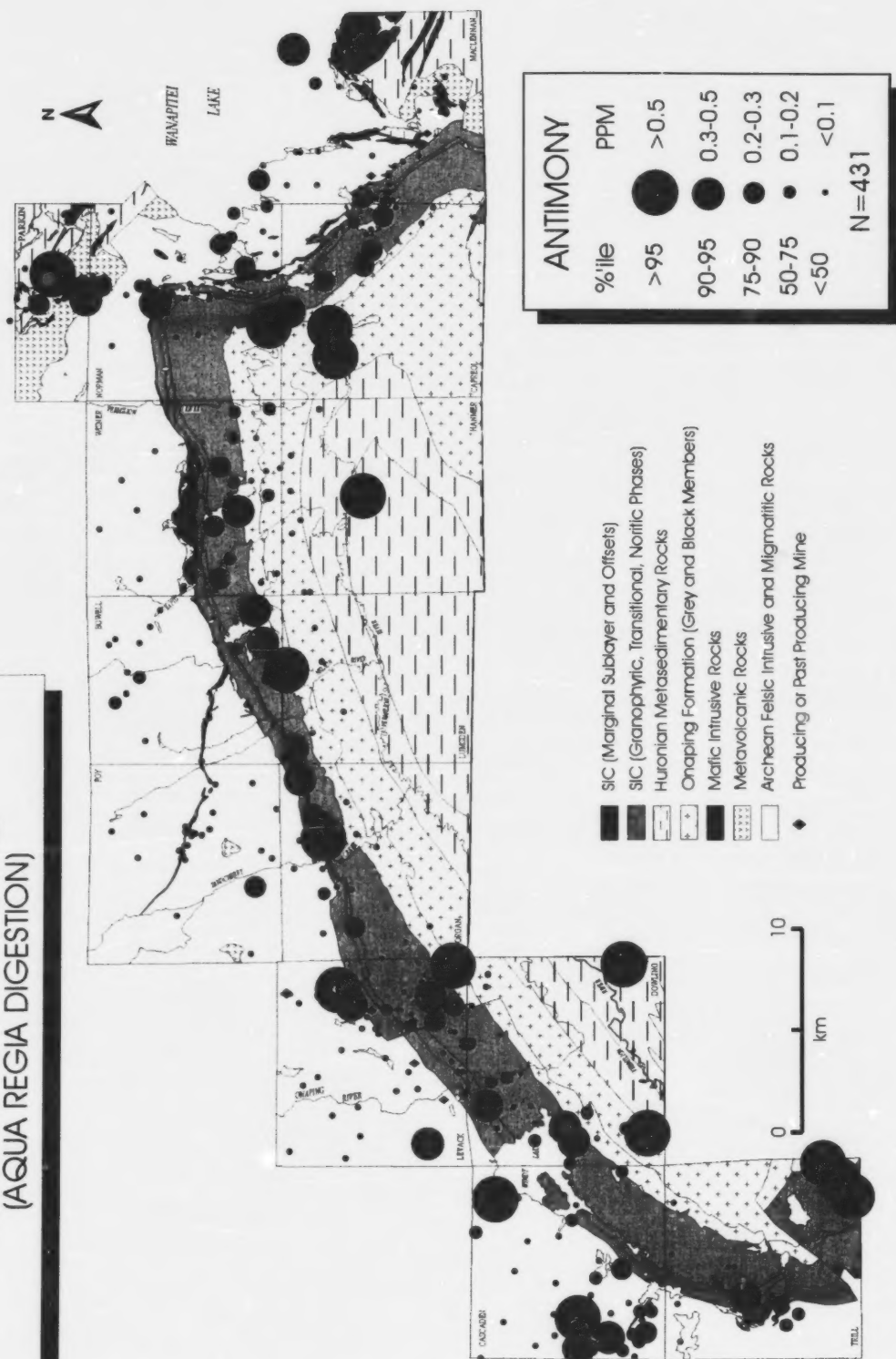




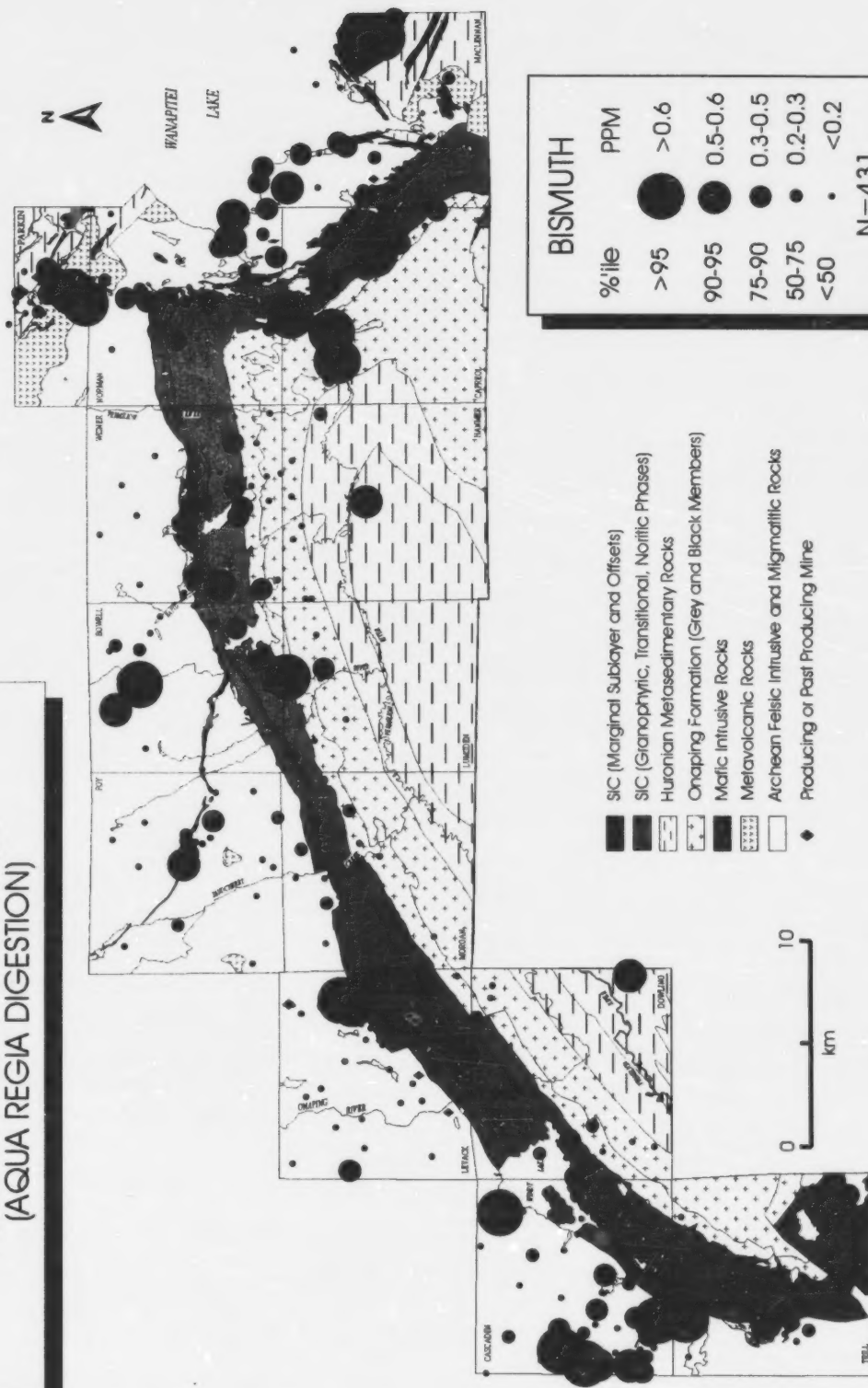
# ARSENIC IN THE <63 MICRON FRACTION OF C-HORIZON TILL (AQUA REGIA DIGESTION)



# ANTIMONY IN THE <63 MICRON FRACTION OF C-HORIZON TILL (AQUA REGIA DIGESTION)



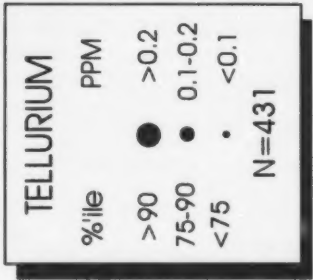
# BISMUTH IN THE <63 MICRON FRACTION OF C-HORIZON TILL (AQUA REGIA DIGESTION)



SELENIUM IN THE <63 MICRON  
FRACTION OF C-HORIZON TILL  
(AQUA REGIA DIGESTION)

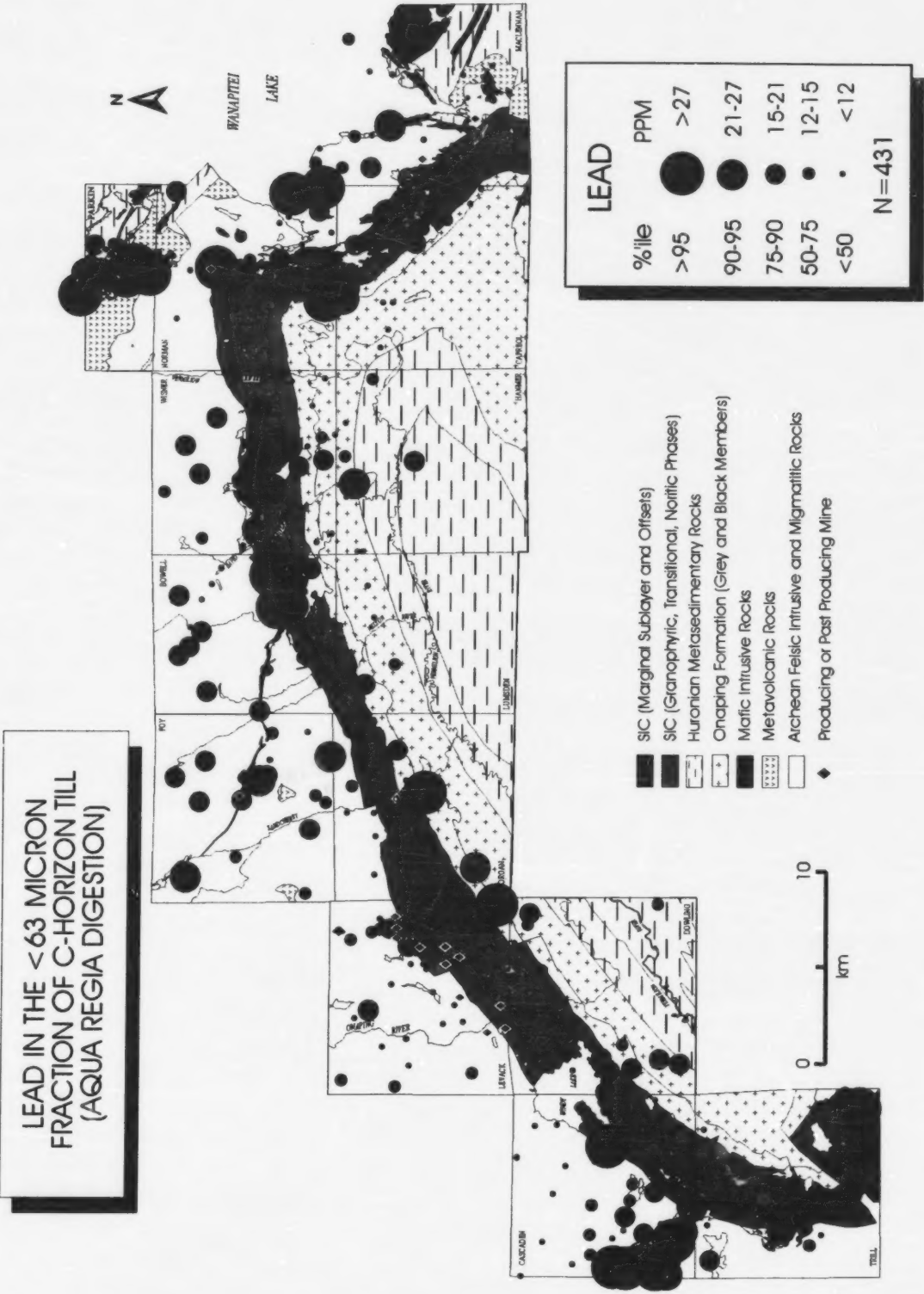


TELLURIUM IN THE <63 MICRON  
FRACTION OF C-HORIZON TILL  
(AQUA REGIA DIGESTION)



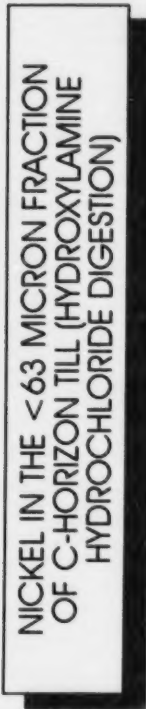


LEAD IN THE <63 MICRON  
FRACTION OF C-HORIZON TILL  
(AQUA REGIA DIGESTION)

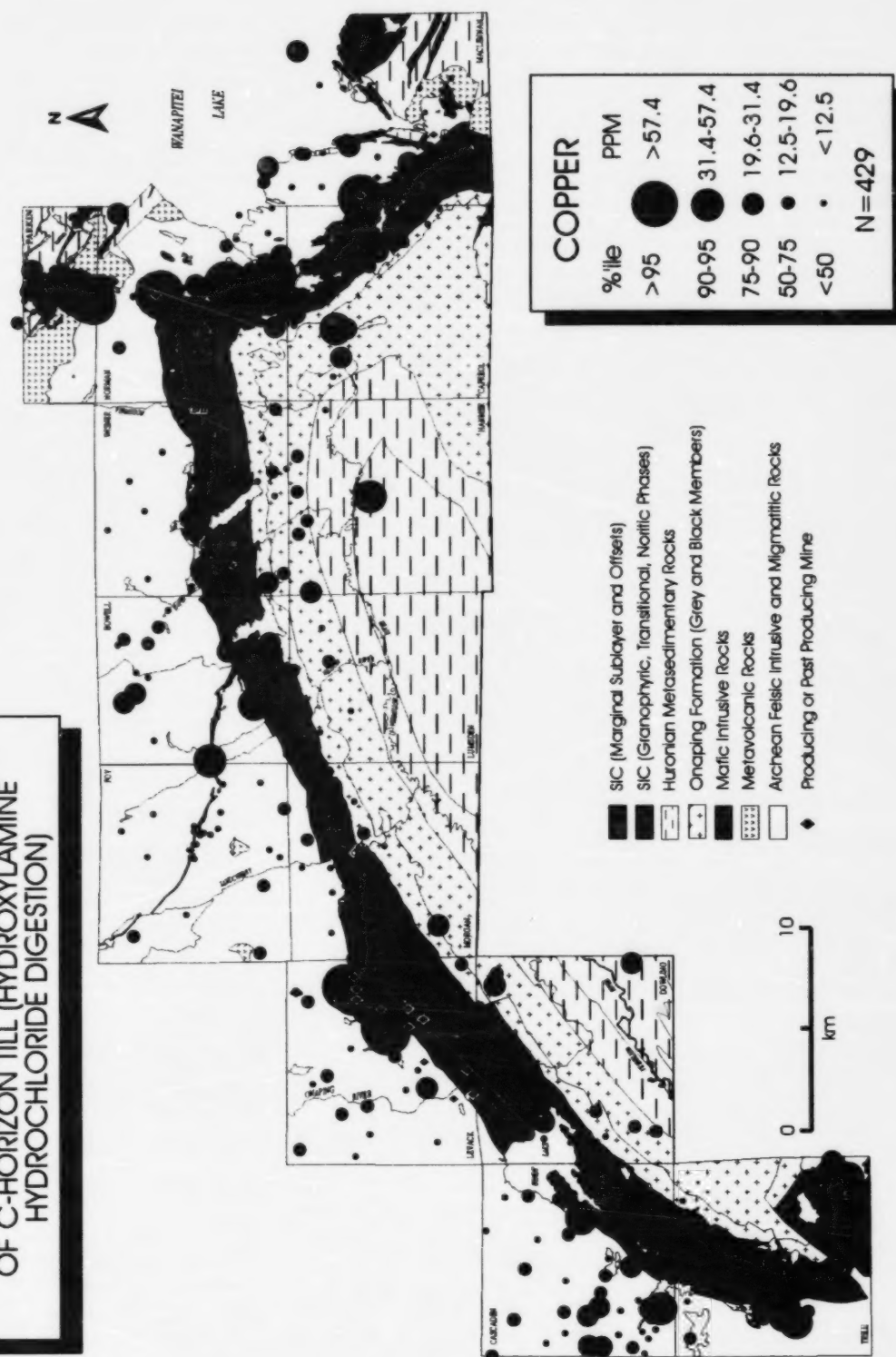


**Appendix I. Regional geochemical plots for C-horizon till (Hydroxylamine  
Hydrochloride Digestion)**

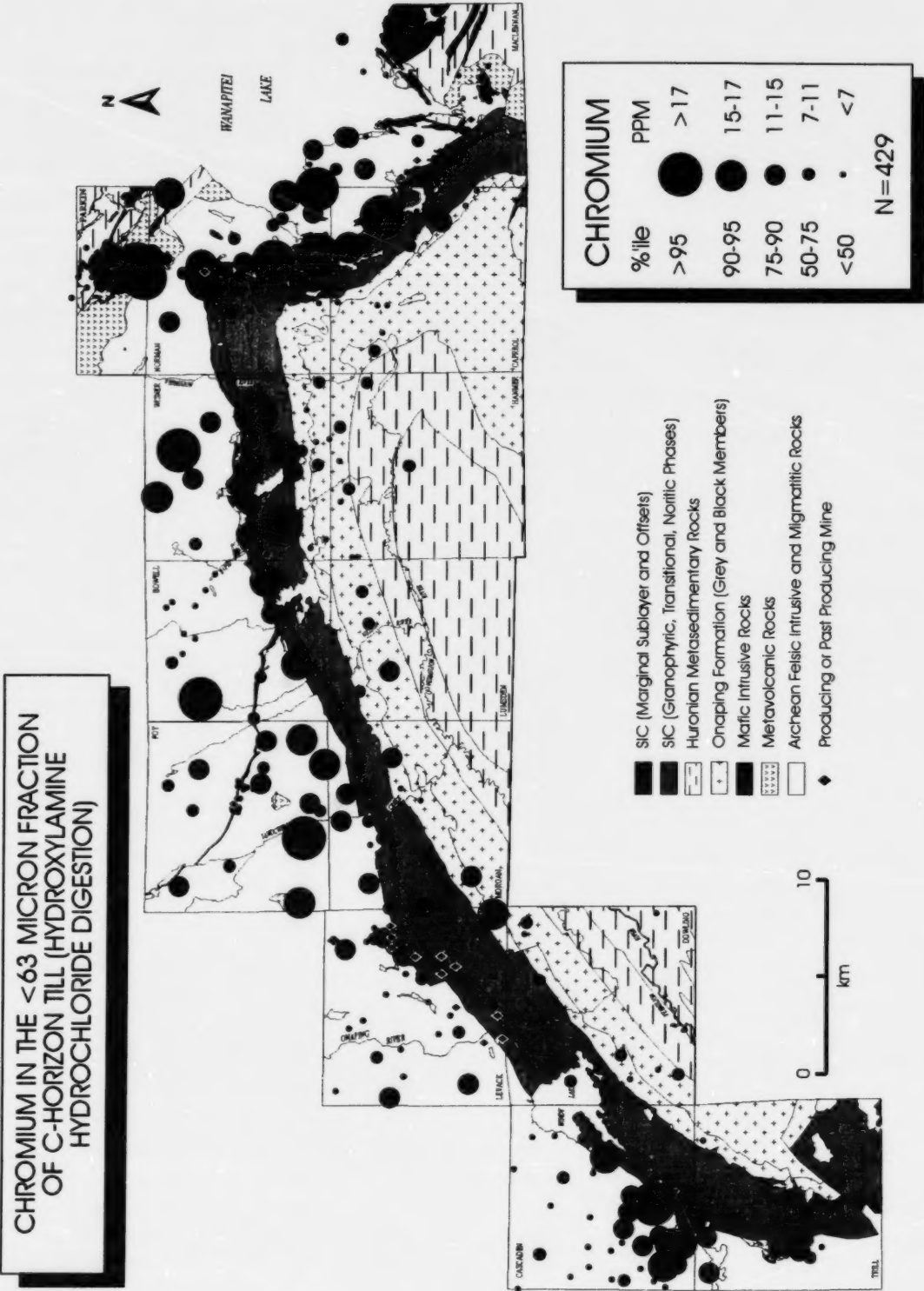
NICKEL IN THE <63 MICRON FRACTION  
OF C-HORIZON TILL (HYDROXYLAMINE  
HYDROCHLORIDE DIGESTION)



COPPER IN THE <63 MICRON FRACTION  
OF C-HORIZON TILL (HYDROXYLAMINE  
HYDROCHLORIDE DIGESTION)

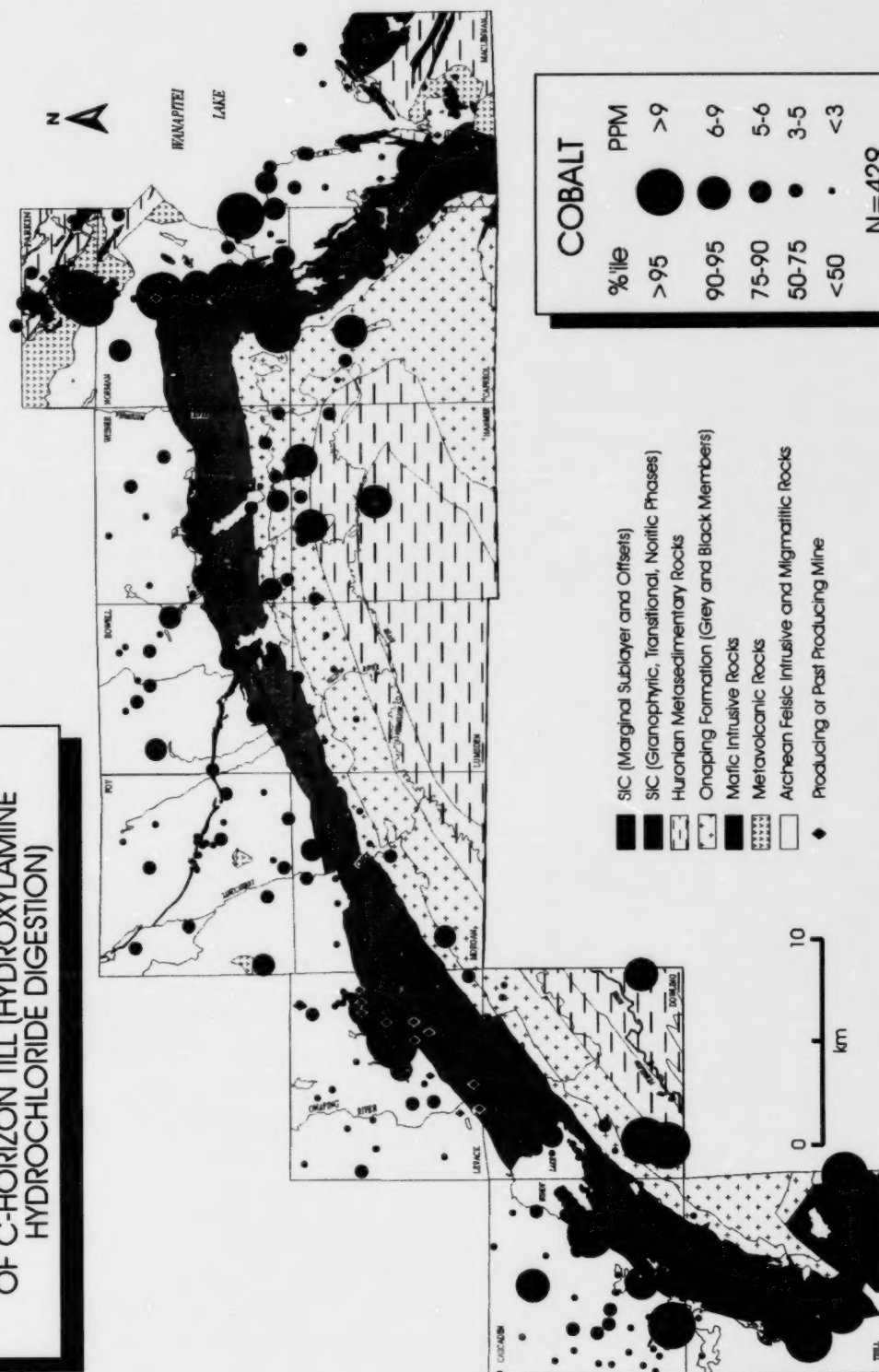


CHROMIUM IN THE <63 MICRON FRACTION  
OF C-HORIZON TILL (HYDROXYLAMINE  
HYDROCHLORIDE DIGESTION)

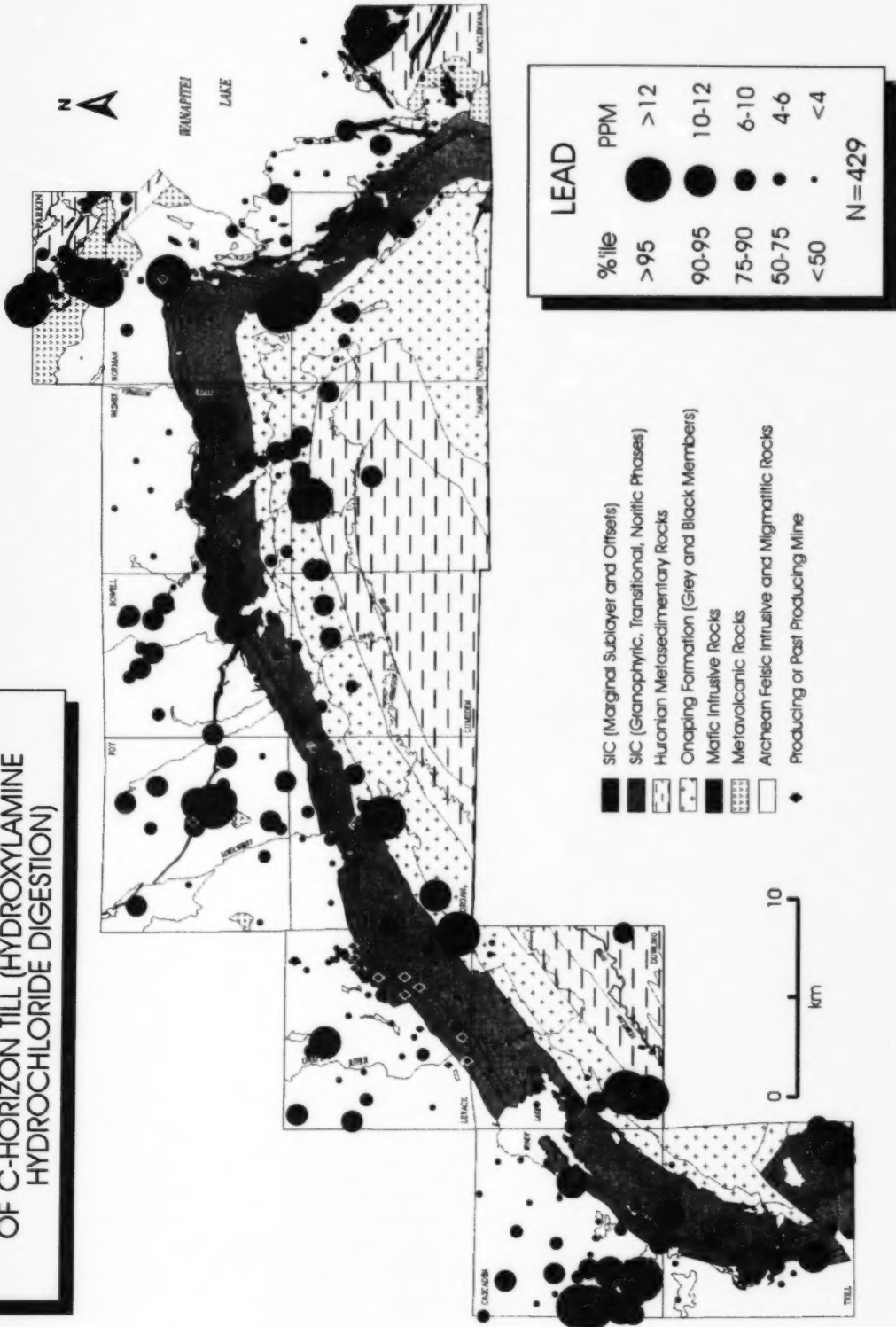




COBALT IN THE <63 MICRON FRACTION  
OF C-HORIZON TILL (HYDROXYLAMINE  
HYDROCHLORIDE DIGESTION)

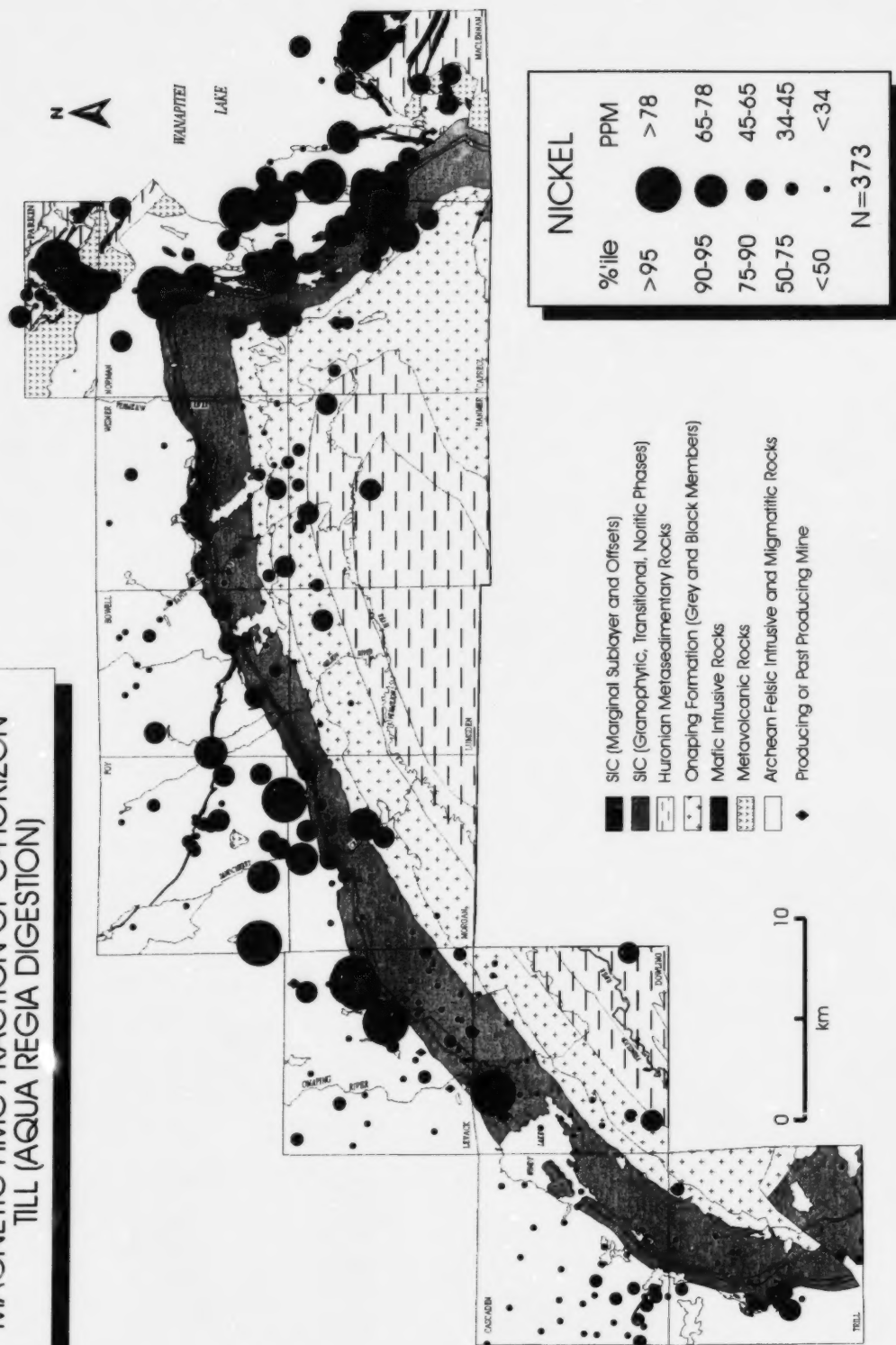


LEAD IN THE <63 MICRON FRACTION  
OF C-HORIZON TILL (HYDROXYLAMINE  
HYDROCHLORIDE DIGESTION)

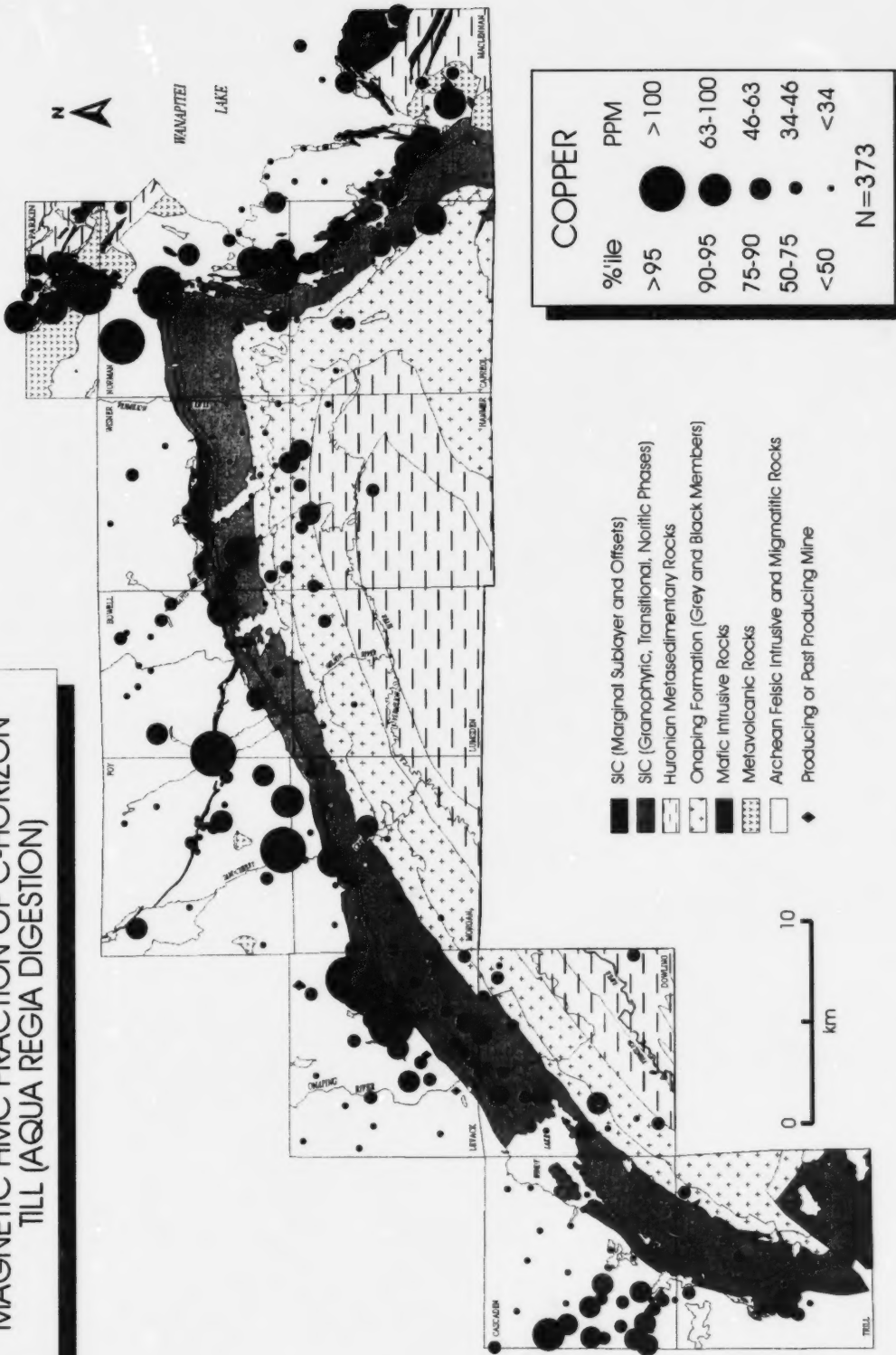


**Appendix J. Regional geochemical plots for the non-magnetic HMC fraction of  
C-horizon till (Aqua Regia Digestion)**

# NICKEL IN THE <2 mm NON-MAGNETIC HMC FRACTION OF C-HORIZON TILL (AQUA REGIA DIGESTION)

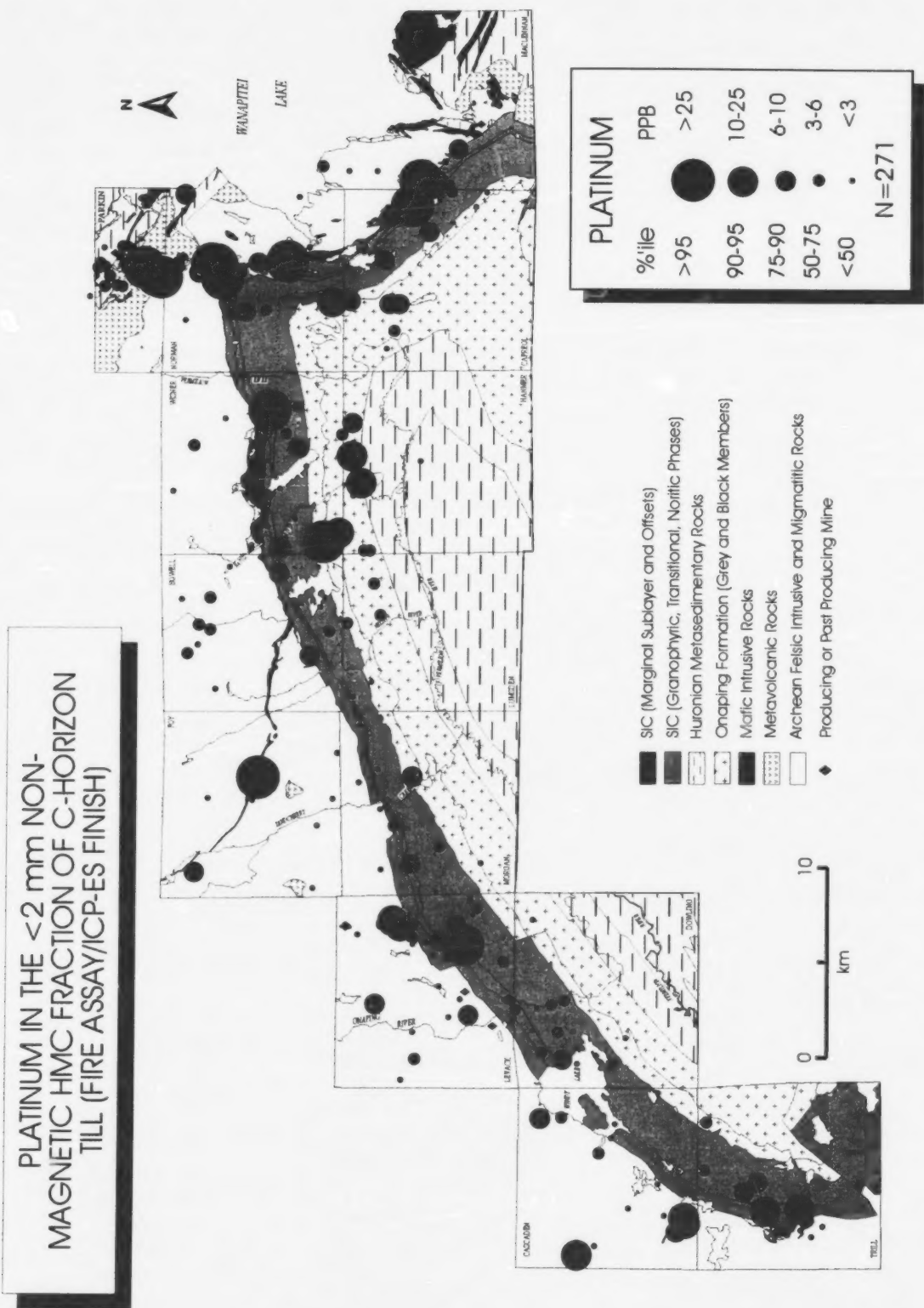


COPPER IN THE <2 mm NON-MAGNETIC HMC FRACTION OF C-HORIZON TILL (AQUA REGIA DIGESTION)

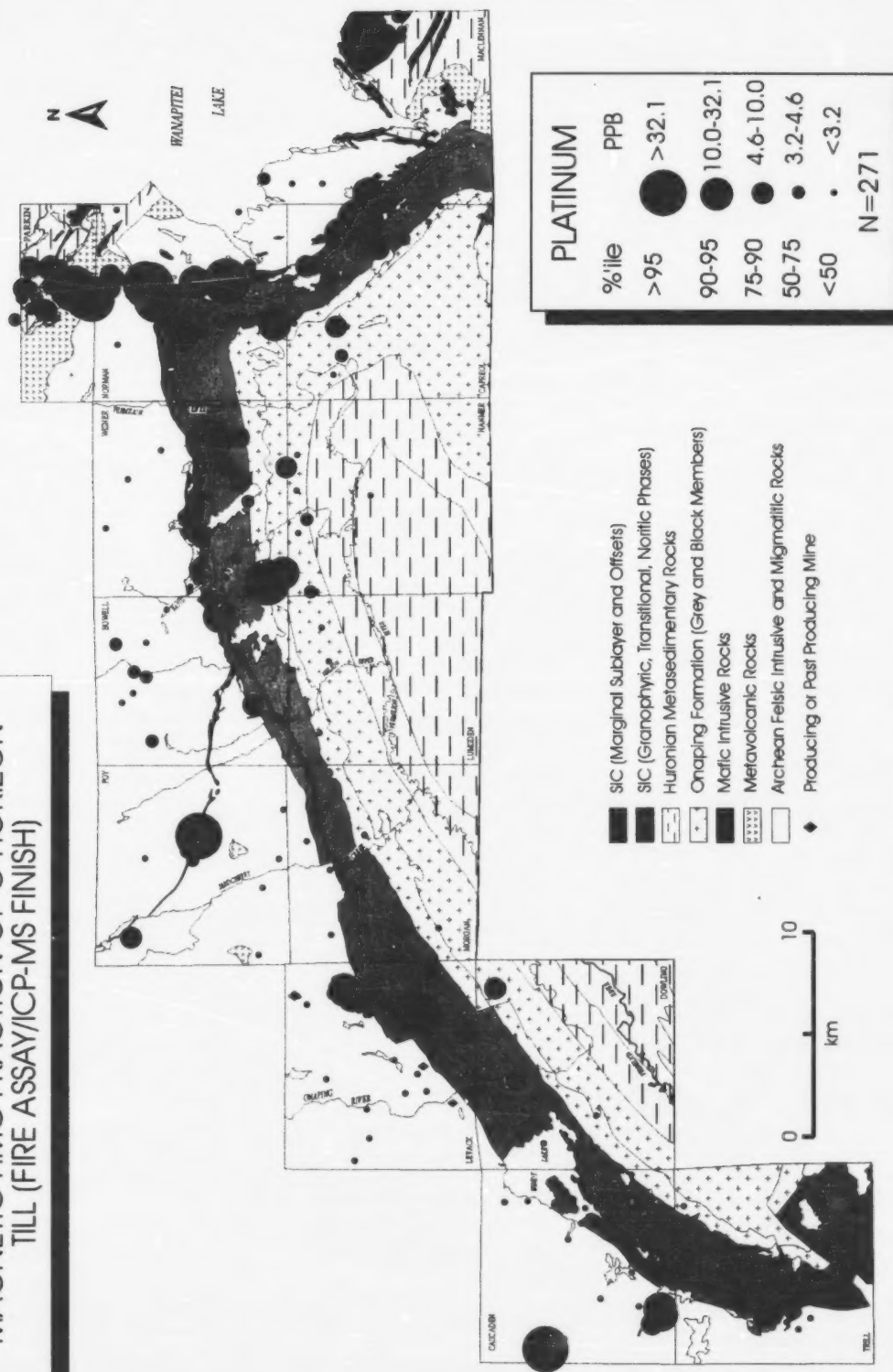




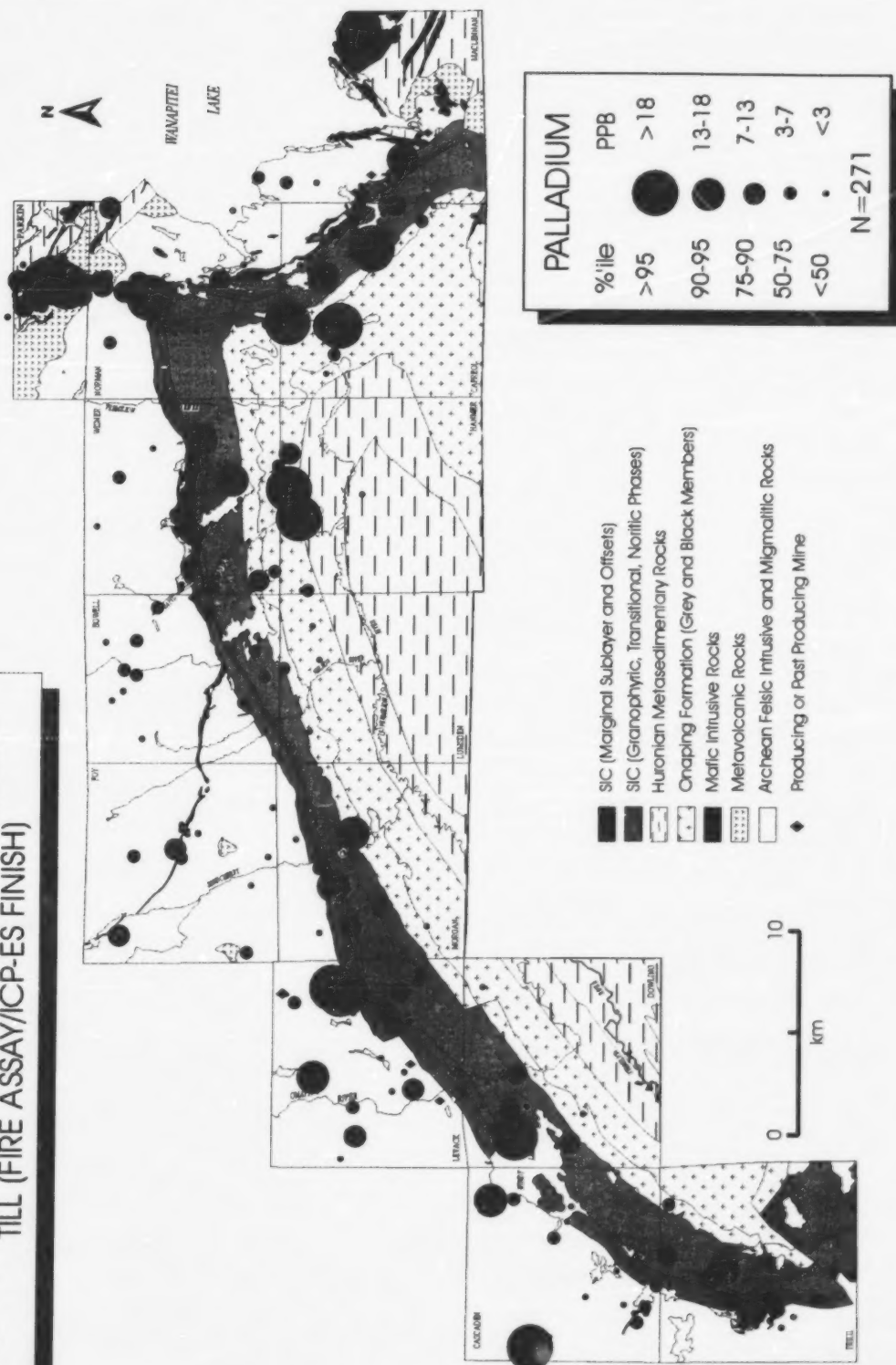
PLATINUM IN THE <2 mm NON-MAGNETIC HMC FRACTION OF C-HORIZON TILL (FIRE ASSAY/ICP-ES FINISH)



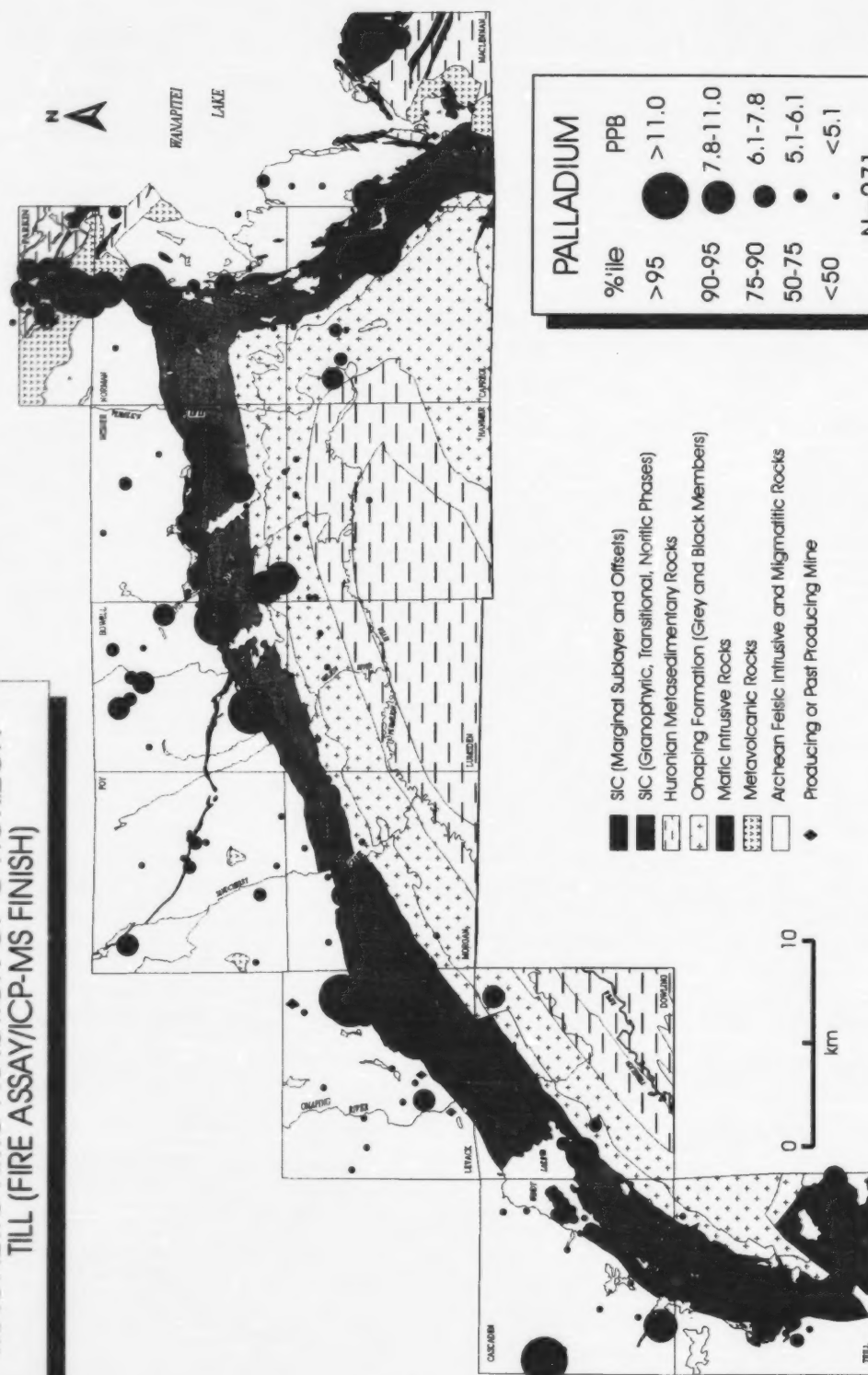
PLATINUM IN THE <2 mm NON-MAGNETIC HMC FRACTION OF C-HORIZON TILL (FIRE ASSAY/ICP-MS FINISH)



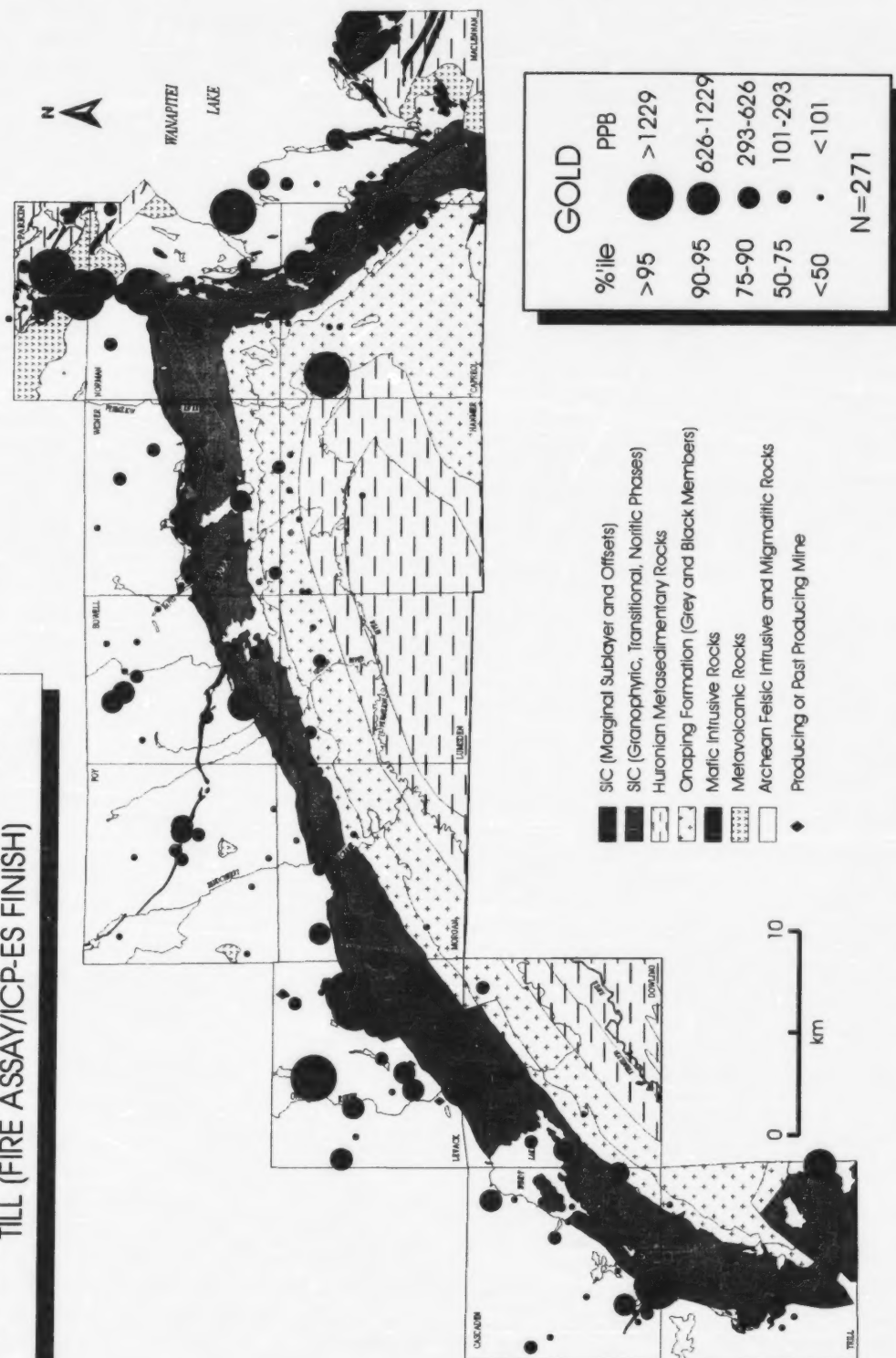
PALLADIUM IN THE <2 mm NON-MAGNETIC HMC FRACTION OF C-HORIZON TILL (FIRE ASSAY/ICP-ES FINISH)



PALLADIUM IN THE <2 mm NON-MAGNETIC HMC FRACTION OF C-HORIZON TILL (FIRE ASSAY/ICP-MS FINISH)

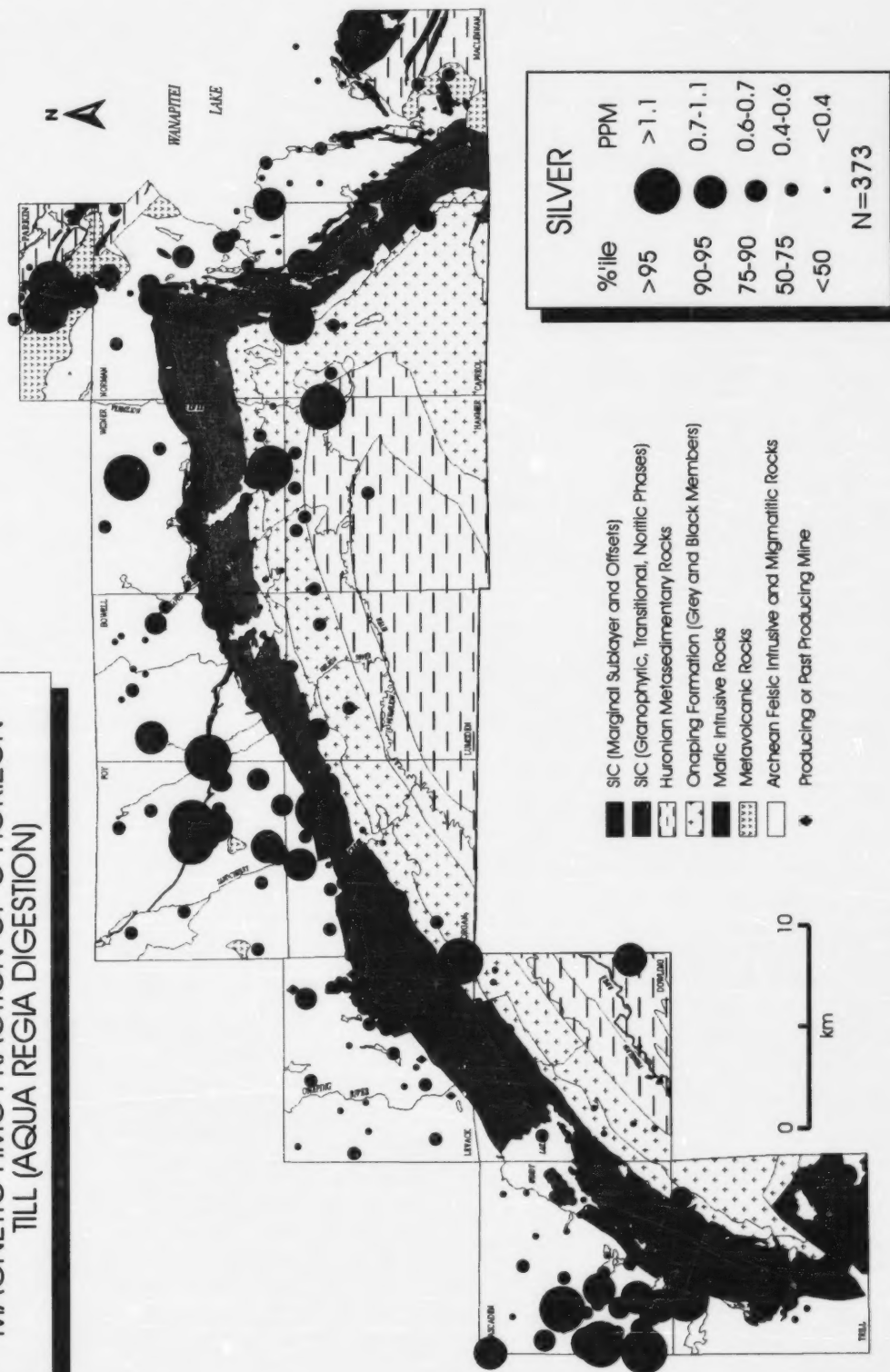


**GOLD IN THE <2 mm NON-MAGNETIC HMC FRACTION OF C-HORIZON TILL (FIRE ASSAY/ICP-ES FINISH)**



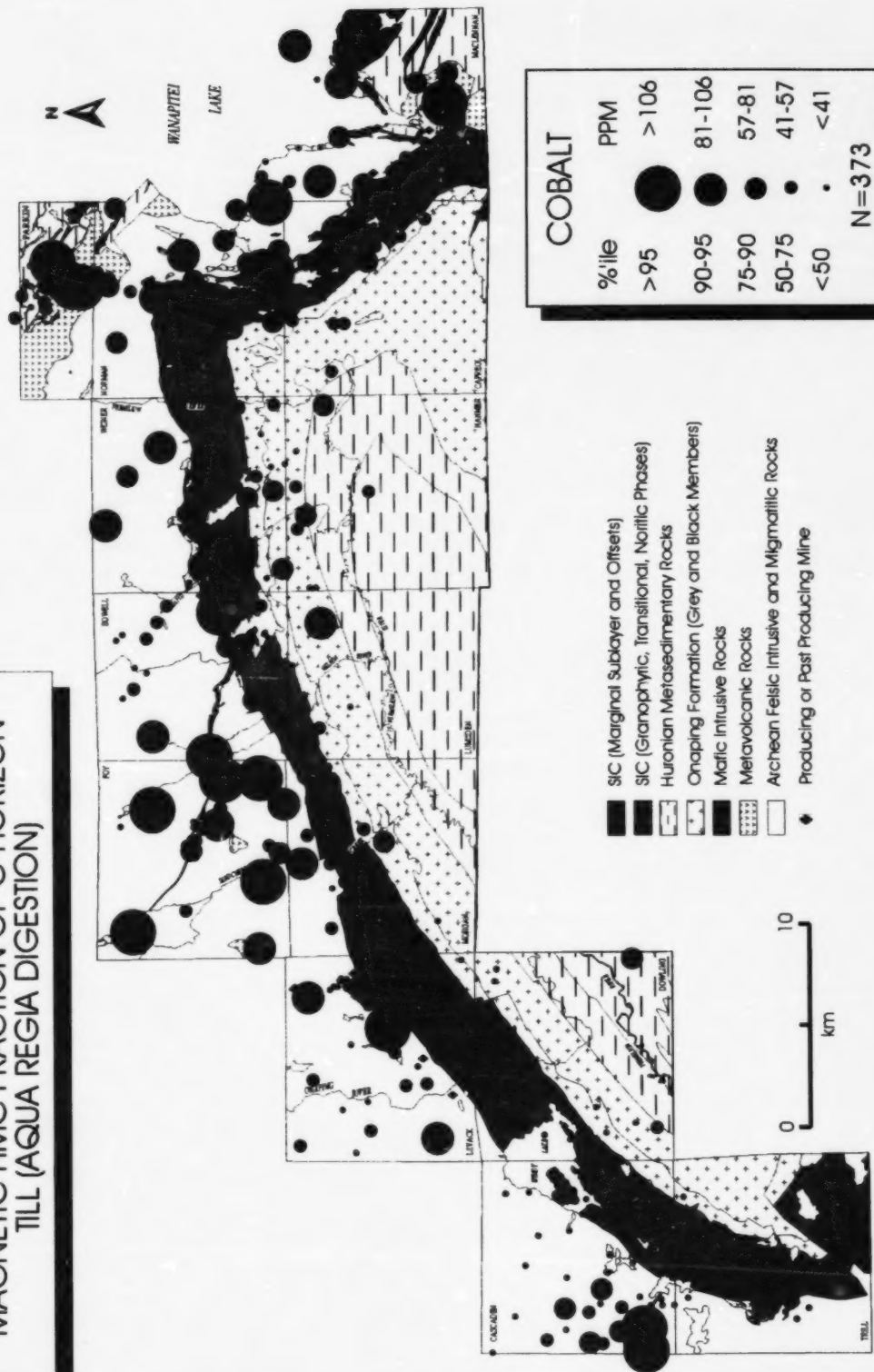


# SILVER IN THE <2 mm NON-MAGNETIC HMC FRACTION OF C-HORIZON TILL (AQUA REGIA DIGESTION)

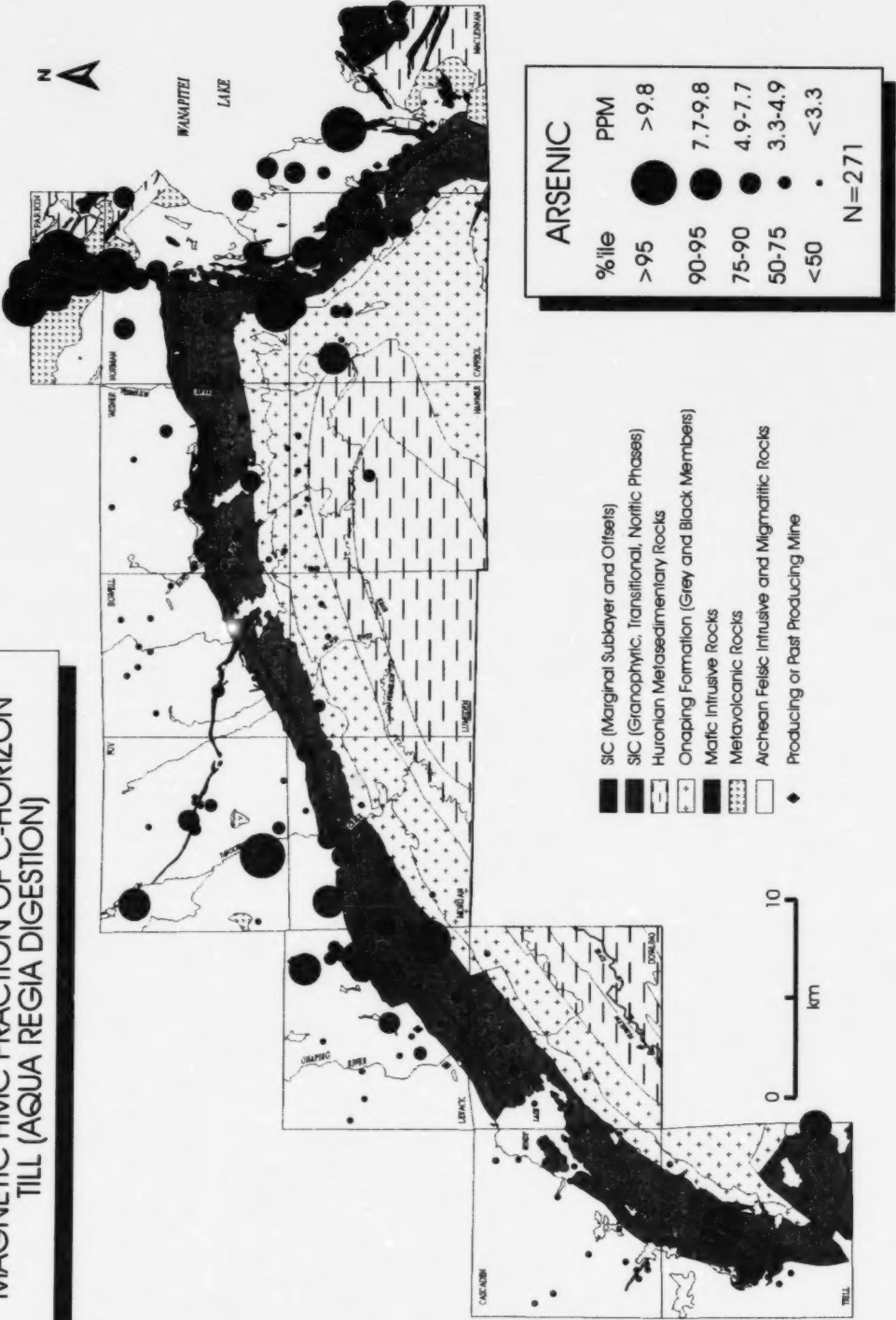




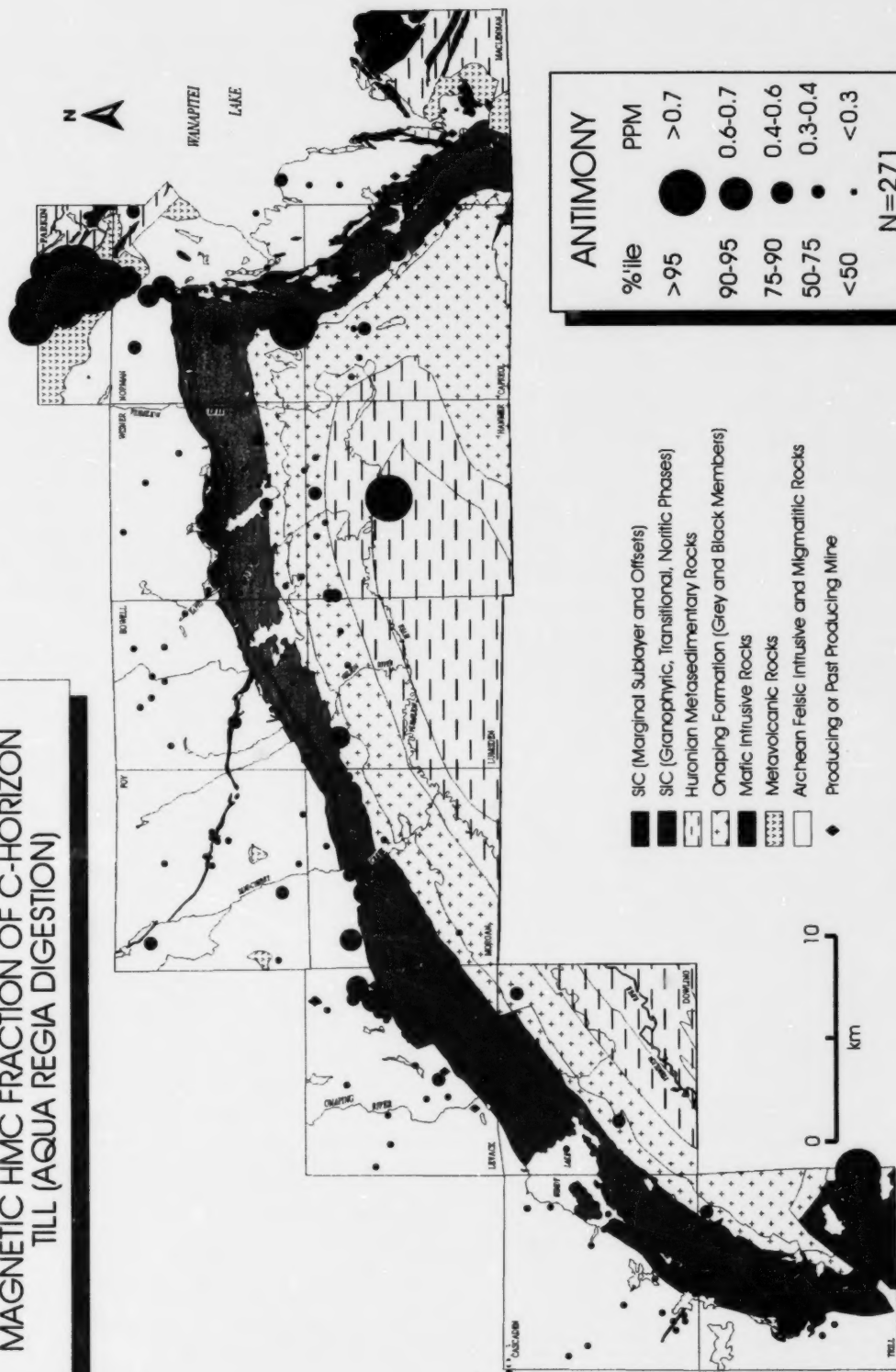
COBALT IN THE <2 mm NON-  
MAGNETIC HMC FRACTION OF C-HORIZON  
TILL (AQUA REGIA DIGESTION)



ARSENIC IN THE <2 mm NON-MAGNETIC HMC FRACTION OF C-HORIZON TILL (AQUA REGIA DIGESTION)

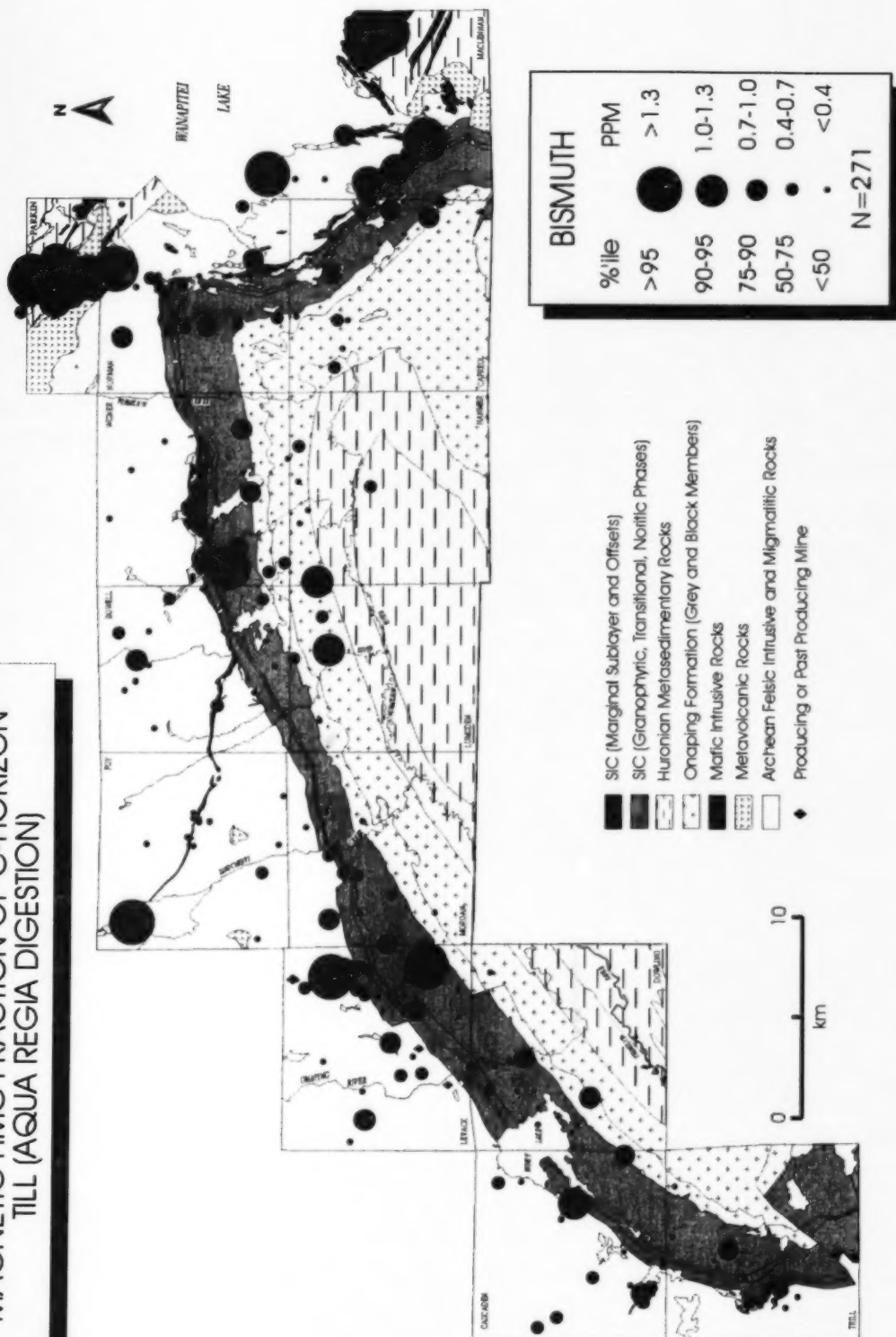


ANTIMONY IN THE <2 mm NON-  
MAGNETIC HMC FRACTION OF C-HORIZON  
TILL (AQUA REGIA DIGESTION)

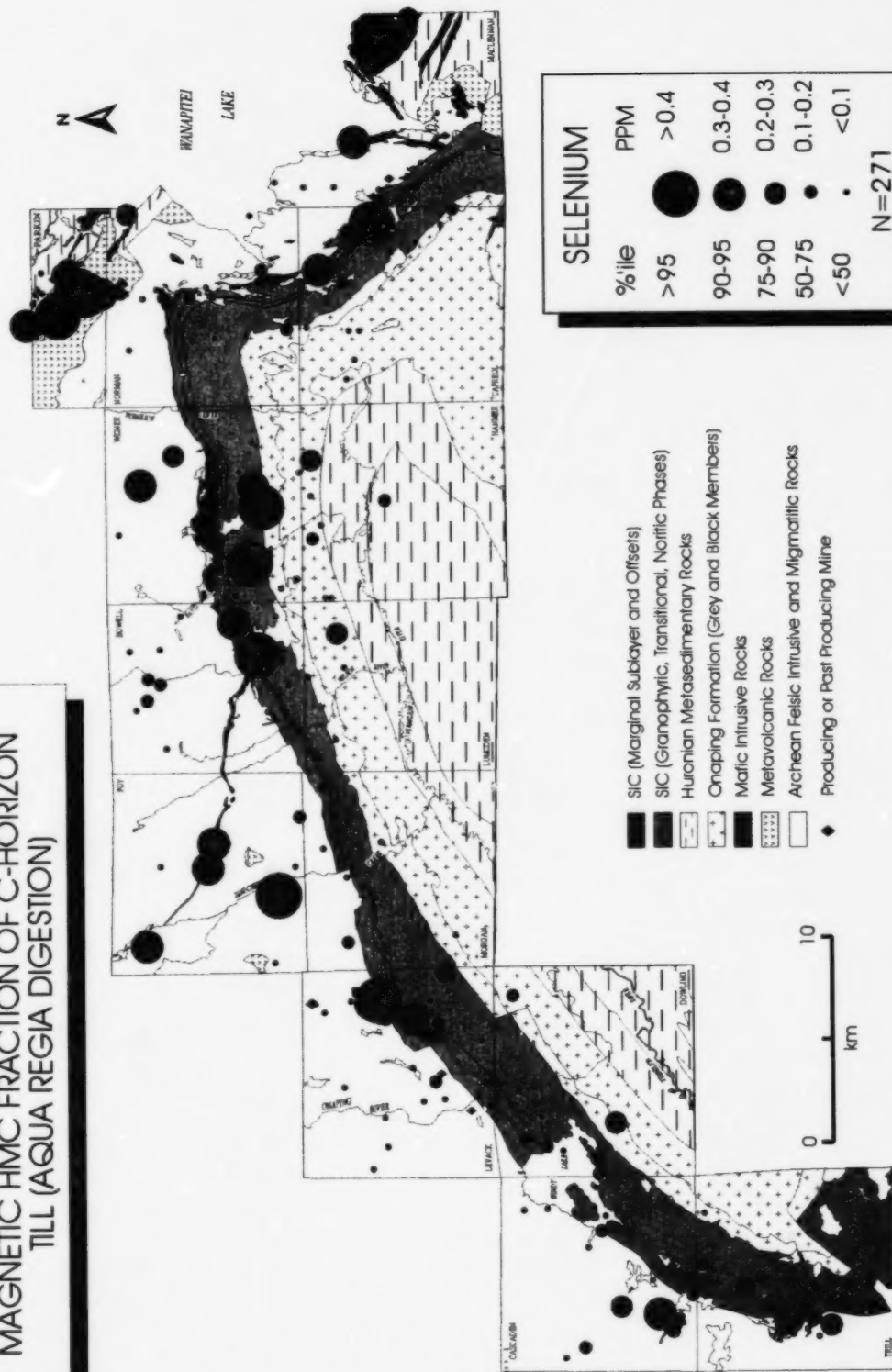




# BISMUTH IN THE <2 mm NON-MAGNETIC HMC FRACTION OF C-HORIZON TILL (AQUA REGIA DIGESTION)



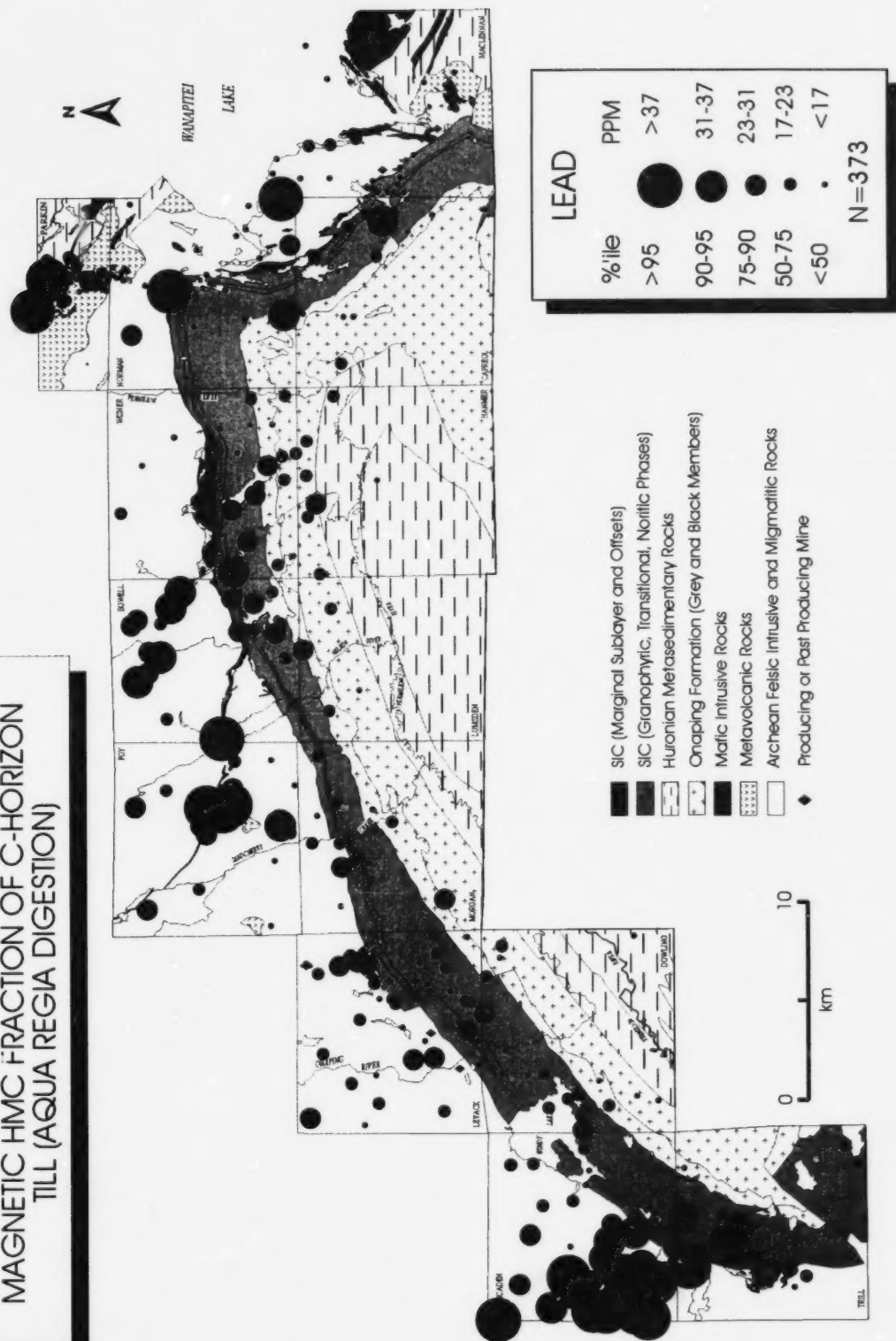
# SELENIUM IN THE <2 mm NON-MAGNETIC HMC FRACTION OF C-HORIZON TILL (AQUA REGIA DIGESTION)



TELLURIUM IN THE <2 mm NON-MAGNETIC HMC FRACTION OF C-HORIZON TILL (AQUA REGIA DIGESTION)



LEAD IN THE <2 mm NON-  
MAGNETIC HMC FRACTION OF C-HORIZON  
TILL (AQUA REGIA DIGESTION)



**Appendix K. Summary statistics for the 7 geochemical datasets.**



Appendix K. Summary statistics for humus (aqua regia digestion).

| Element | Units | Sample Size | Mean | Median | Mode | Geometric Mean | Variance | Standard Deviation | Minimum | Maximum | Range | Percentiles: |      |      |      |      |
|---------|-------|-------------|------|--------|------|----------------|----------|--------------------|---------|---------|-------|--------------|------|------|------|------|
|         |       |             |      |        |      |                |          |                    |         |         |       | 99           | 95   | 90   | 75   | 25   |
| Ag      | ppm   | 420         | 0.7  | 0.6    | 0.5  | 0.6            | 0        | 0                  | 0.1     | 2.2     | 2.1   | 1.7          | 1.3  | 1.2  | 0.9  | 0.4  |
| Al      | %     | 420         | 0.39 | 0.36   | 0.31 | 0.37           | 0.02     | 0.16               | 0.16    | 1.33    | 1.17  | 1.08         | 0.65 | 0.57 | 0.43 | 0.30 |
| As      | ppm   | 406         | 10.7 | 7.1    | 3.4  | 6.9            | 226.2    | 15.0               | 0.3     | 152.2   | 151.9 | 87.5         | 30.9 | 19.3 | 11.0 | 7.05 |
| Au      | ppb   | 411         | 16.2 | 12.4   | 12.4 | 13.3           | 128.9    | 11.4               | 0.5     | 85.2    | 84.7  | 59.6         | 37.6 | 31.6 | 20.5 | 12.4 |
| Ba      | ppm   | 420         | 170  | 150    | 112  | 147            | 9518     | 98                 | 30      | 673     | 643   | 489          | 383  | 284  | 209  | 150  |
| Bi      | ppm   | 406         | 3.5  | 3.3    | 1.3  | 3.0            | 3.9      | 2.0                | 0.2     | 13.4    | 13.2  | 8.7          | 6.7  | 5.9  | 4.8  | 3.3  |
| Ca      | %     | 420         | 0.42 | 0.37   | 0.28 | 0.36           | 0.06     | 0.25               | 0.08    | 2.16    | 2.08  | 1.43         | 0.79 | 0.66 | 0.54 | 0.37 |
| Cd      | ppm   | 420         | 2.1  | 1.9    | 1.8  | 1.8            | 1        | 1                  | 0.1     | 10.6    | 10.5  | 6.3          | 3.9  | 3.2  | 2.5  | 1.3  |
| Co      | ppm   | 420         | 20   | 15     | 9    | 17             | 203      | 14                 | 3       | 117     | 114   | 63           | 49   | 40   | 25   | 15   |
| Cr      | ppm   | 420         | 15   | 13     | 9    | 14             | 60       | 8                  | 6       | 99      | 93    | 45           | 27   | 23   | 17   | 13   |
| Cu      | ppm   | 420         | 408  | 324    | 272  | 339            | 79980    | 283                | 63      | 2363    | 2300  | 1363         | 959  | 755  | 491  | 324  |
| Fe      | %     | 420         | 1.65 | 1.35   | 0.93 | 1.46           | 0.85     | 0.92               | 0.39    | 8.40    | 8.01  | 4.85         | 3.21 | 2.73 | 2.07 | 1.35 |
| Ge      | ppm   | 406         | 0.2  | 0.2    | 0.2  | 0.2            | 0.02     | 0.1                | 0.05    | 0.8     | 0.8   | 0.5          | 0.5  | 0.4  | 0.3  | 0.2  |
| K       | %     | 420         | 0.08 | 0.08   | 0.08 | 0.08           | 0.00     | 0.03               | 0.03    | 0.18    | 0.15  | 0.16         | 0.13 | 0.12 | 0.10 | 0.08 |
| La      | ppm   | 420         | 5    | 4      | 3    | 5              | 10       | 3                  | 1       | 32      | 31    | 21           | 9    | 8    | 6    | 4    |
| Mg      | %     | 420         | 0.10 | 0.08   | 0.08 | 0.09           | 0.00     | 0.05               | 0.03    | 0.39    | 0.36  | 0.32         | 0.20 | 0.15 | 0.10 | 0.08 |
| Mn      | ppm   | 420         | 560  | 173    | 138  | 223            | 0        | 1422               | 20      | 15376   | 15356 | 7623         | 2084 | 1216 | 410  | 173  |
| Mo      | ppm   | 420         | 1.5  | 1.0    | 2.0  | 1.2            | 1        | 1                  | 0.5     | 10.0    | 9.5   | 4.0          | 3.0  | 2.0  | 2.0  | 1.0  |
| Na      | %     | 420         | 0.06 | 0.06   | 0.05 | 0.06           | 0.00     | 0.02               | 0.03    | 0.24    | 0.21  | 0.11         | 0.10 | 0.09 | 0.08 | 0.06 |
| Ni      | ppm   | 420         | 474  | 378    | 370  | 399            | 93181    | 305                | 80      | 1933    | 1853  | 1456         | 1143 | 910  | 574  | 378  |
| Pb      | ppm   | 420         | 163  | 152    | 162  | 148            | 11456    | 107                | 16      | 1506    | 1490  | 352          | 268  | 228  | 191  | 152  |
| Pd      | ppb   | 411         | 28.5 | 21.9   | 21.9 | 23.0           | 419.3    | 20.5               | 2.3     | 117.5   | 115.2 | 101.0        | 75.6 | 57.5 | 34.0 | 21.9 |
| Pt      | ppb   | 411         | 27.6 | 21.2   | 21.2 | 22.1           | 404.6    | 20.1               | 2.8     | 120.7   | 117.9 | 107.7        | 70.2 | 56.9 | 33.9 | 21.2 |
| Sb      | ppm   | 406         | 0.5  | 0.5    | 0.4  | 0.4            | 0.4      | 0.6                | 0.05    | 8.5     | 8.5   | 1.8          | 1.0  | 0.9  | 0.7  | 0.5  |
| Sc      | ppm   | 420         | 2.5  | 2.5    | 2.5  | 2.5            | 0        | 0                  | 2.5     | 2.5     | 0     | 2.5          | 2.5  | 2.5  | 2.5  | 2.5  |
| Se      | ppm   | 406         | 2.5  | 2.4    | 1.0  | 1.9            | 3.5      | 1.9                | 0.05    | 16.3    | 16.3  | 9.2          | 4.9  | 4.1  | 3.3  | 2.4  |
| Sn      | ppm   | 420         | 11   | 10     | 10   | 10             | 37       | 6                  | 10      | 119     | 109   | 27           | 10   | 10   | 10   | 10   |
| Sr      | ppm   | 420         | 25   | 23     | 18   | 23             | 136      | 12                 | 7       | 91      | 84    | 65           | 46   | 40   | 30   | 23   |
| Te      | ppm   | 406         | 0.3  | 0.2    | 0.1  | 0.2            | 0.6      | 0.8                | 0.05    | 8.3     | 8.3   | 5.8          | 0.7  | 0.5  | 0.3  | 0.2  |
| V       | ppm   | 420         | 15   | 13     | 11   | 14             | 52       | 7                  | 6       | 93      | 87    | 39           | 26   | 21   | 17   | 13   |
| W       | ppm   | 420         | 10   | 10     | 10   | 10             | 0        | 0                  | 10      | 10      | 0     | 10           | 10   | 10   | 10   | 10   |
| Y       | ppm   | 420         | 1.2  | 1.0    | 1.0  | 1.0            | 1        | 1                  | 0.5     | 9.0     | 8.5   | 5.0          | 2.0  | 2.0  | 2.0  | 1.0  |
| Zn      | ppm   | 420         | 101  | 85     | 66   | 88             | 8255     | 91                 | 15      | 1560    | 1545  | 376          | 202  | 153  | 114  | 85   |

Appendix K. Summary statistics for humus (sodium pyrophosphate digestion).

| Element | Units | Sample Size | Mean    | Median  | Mode    | Geometric Mean | Variance  | Standard Deviation | Minimum | Maximum | Range   | Percentiles: |         |         |         |         |         |  |  |
|---------|-------|-------------|---------|---------|---------|----------------|-----------|--------------------|---------|---------|---------|--------------|---------|---------|---------|---------|---------|--|--|
|         |       |             |         |         |         |                |           |                    |         |         |         | 99           | 95      | 90      | 75      | 50      | 25      |  |  |
| Co      | ppm   | 421         | 2.7     | 2.0     | 2.0     |                | 3.9       | 1.9                | 1.0     | 15.0    | 14.0    | 9.0          | 7.0     | 5.0     | 4.0     | 2.0     | 1.0     |  |  |
| Co(N)   | -     | 421         | 0.00007 | 0.00005 | 0.00003 |                | 0.00000   | 0.00006            | 0.00001 | 0.00041 | 0.00041 | 0.00029      | 0.00018 | 0.00015 | 0.00009 | 0.00005 | 0.00003 |  |  |
| Cu      | ppm   | 421         | 169     | 126     | 86      | 128            | 20532     | 143                | 20      | 1256    | 1236    | 651          | 460     | 357     | 197     | 126     | 76      |  |  |
| Cu(N)   | -     | 421         | 0.00396 | 0.00319 | 0.00319 | 0.00325        | 0.00001   | 0.00294            | 0.00038 | 0.03455 | 0.03417 | 0.01388      | 0.00818 | 0.00735 | 0.00510 | 0.00319 | 0.00226 |  |  |
| Fe      | ppm   | 421         | 2701    | 2300    | 1650    | 2399           | 2628830   | 1621               | 642     | 15430   | 14788   | 9450         | 5600    | 4280    | 3050    | 2300    | 1762    |  |  |
| Fe(N)   | -     | 421         | 0.06656 | 0.05931 | 0.05931 | 0.06083        | 0.00201   | 0.04480            | 0.02119 | 0.82298 | 0.80179 | 0.15375      | 0.11282 | 0.09755 | 0.07572 | 0.05931 | 0.04755 |  |  |
| Mn      | ppm   | 421         | 225     | 116     | 41      | 115            | 119181    | 345                | 2       | 4200    | 4198    | 1730         | 749     | 537     | 252     | 116     | 52      |  |  |
| Mn(N)   | -     | 421         | 0.00686 | 0.00276 | 0.00276 | 0.00292        | 0.00014   | 0.01201            | 0.00007 | 0.16080 | 0.16073 | 0.05366      | 0.02615 | 0.01795 | 0.00817 | 0.00276 | 0.00112 |  |  |
| Ni      | ppm   | 421         | 61      | 48      | 32      | 49             | 2146      | 46                 | 8       | 480     | 472     | 206          | 148     | 112     | 73      | 48      | 32      |  |  |
| Ni(N)   | -     | 421         | 0.00152 | 0.00124 | 0.00124 | 0.00124        | 0.00000   | 0.00134            | 0.00027 | 0.01980 | 0.01953 | 0.00495      | 0.00334 | 0.00271 | 0.00178 | 0.00124 | 0.00085 |  |  |
| Pb      | ppm   | 421         | 109     | 102     | 95      | 97             | 8254      | 91                 | 6       | 1342    | 1336    | 236          | 179     | 150     | 127     | 102     | 78      |  |  |
| Pb(N)   | -     | 421         | 0.00284 | 0.00253 | 0.00229 | 0.00245        | 0.00001   | 0.00290            | 0.00025 | 0.03967 | 0.03943 | 0.00579      | 0.00440 | 0.00394 | 0.00324 | 0.00253 | 0.00204 |  |  |
| Zn      | ppm   | 421         | 51      | 40      | 29      | 41             | 1547      | 39                 | 5       | 296     | 291     | 227          | 125     | 93      | 61      | 40      | 28      |  |  |
| Zn(N)   | -     | 421         | 0.00148 | 0.00098 | 0.00119 | 0.00103        | 0.00000   | 0.00154            | 0.00007 | 0.01203 | 0.01197 | 0.00853      | 0.00443 | 0.00306 | 0.00175 | 0.00098 | 0.00061 |  |  |
| C - Org | ppm   | 421         | 42211   | 39424   | 39424   | 39434          | 253148000 | 15911              | 2576    | 127180  | 124604  | 88744        | 70920   | 62600   | 50260   | 39424   | 30568   |  |  |
| LOI     | %     | 226         | 48.03   | 48.22   | 46.34   | 45.62          | 214.46    | 14.64              | 13.35   | 85.46   | 72.11   | 78.84        | 72.94   | 67.58   | 59.09   | 48.22   | 36.17   |  |  |

Appendix K. Summary statistics for B-horizon till (aqua regia digestion).

| Element | Units | Sample Size | Mean | Median | Mode | Geometric Mean | Variance | Standard Deviation | Minimum | Maximum | Range | Percentiles: |      |      |      |      |      |      |      |
|---------|-------|-------------|------|--------|------|----------------|----------|--------------------|---------|---------|-------|--------------|------|------|------|------|------|------|------|
|         |       |             |      |        |      |                |          |                    |         |         |       | 99           | 95   | 90   | 75   | 50   | 25   | 10   | 5    |
| Ag      | ppm   | 427         | 0.4  | 0.4    | 0.5  | 0.3            | 0.16     | 0.40               | 0.1     | 6.3     | 6.2   | 0.9          | 0.6  | 0.6  | 0.5  | 0.4  | 0.3  | 0.2  | 0.1  |
| Al      | %     | 427         | 2.16 | 2.09   | 1.77 | 2.10           | 0.26     | 0.51               | 0.80    | 4.62    | 3.82  | 3.64         | 3.13 | 2.80 | 2.46 | 2.09 | 1.80 | 1.5  | 1.2  |
| As      | ppm   | 428         | 2.7  | 2.1    | 1.5  | 2.3            | 6.39     | 2.5                | 0.4     | 32.4    | 32.0  | 11.9         | 6.0  | 4.7  | 3.0  | 2.1  | 1.5  | 1.0  | 0.5  |
| Au      | ppb   | 427         | 3.1  | 1.3    | 0.5  | 1.4            | 48.39    | 6.96               | 0.5     | 86.8    | 86.3  | 34.2         | 9.9  | 6.8  | 2.9  | 1.3  | 0.5  | 0.2  | 0.1  |
| Ba      | ppm   | 427         | 44   | 41     | 41   | 41             | 309.35   | 17.59              | 14      | 172     | 158   | 107          | 77   | 65   | 51   | 41   | 32   | 22   | 15   |
| Bi      | ppm   | 428         | 0.3  | 0.2    | 0.2  | 0.2            | 0.03     | 0.2                | 0.05    | 1.3     | 1.3   | 0.8          | 0.6  | 0.5  | 0.3  | 0.2  | 0.1  | 0.1  | 0.1  |
| Ca      | %     | 427         | 0.13 | 0.12   | 0.13 | 0.13           | 0.00     | 0.04               | 0.05    | 0.32    | 0.27  | 0.27         | 0.22 | 0.20 | 0.15 | 0.12 | 0.10 | 0.05 | 0.05 |
| Cd      | ppm   | 427         | 0.2  | 0.1    | 0.1  | 0.2            | 0.05     | 0.22               | 0.1     | 1.2     | 1.1   | 0.9          | 0.7  | 0.6  | 0.4  | 0.1  | 0.1  | 0.1  | 0.1  |
| Co      | ppm   | 427         | 10   | 9      | 7    | 9              | 24.12    | 4.91               | 3       | 63      | 60    | 23           | 18   | 15   | 11   | 9    | 7    | 5    | 3    |
| Cr      | ppm   | 427         | 41   | 36     | 33   | 38             | 547.41   | 23.40              | 19      | 288     | 269   | 128          | 71   | 54   | 43   | 36   | 31   | 24   | 18   |
| Cu      | ppm   | 427         | 31   | 12     | 7    | 14             | 8182.56  | 90.46              | 3       | 855     | 852   | 619          | 90   | 44   | 21   | 12   | 8    | 5    | 3    |
| Fe      | %     | 427         | 2.39 | 2.24   | 2.59 | 2.30           | 0.74     | 0.86               | 1.18    | 10.00   | 8.82  | 4.92         | 3.51 | 3.17 | 2.59 | 2.24 | 1.92 | 1.5  | 1.2  |
| Ge      | ppm   | 428         | 0.1  | 0.1    | 0.1  | 0.1            | 0.00     | 0.1                | 0.05    | 0.5     | 0.5   | 0.3          | 0.2  | 0.1  | 0.1  | 0.05 | 0.05 | 0.05 | 0.05 |
| K       | %     | 427         | 0.04 | 0.03   | 0.03 | 0.04           | 0.00     | 0.01               | 0.01    | 0.13    | 0.13  | 0.09         | 0.06 | 0.05 | 0.04 | 0.03 | 0.03 | 0.03 | 0.03 |
| La      | ppm   | 427         | 10   | 10     | 8    | 10             | 15.04    | 3.88               | 5       | 40      | 35    | 28           | 17   | 14   | 11   | 10   | 8    | 7    | 5    |
| Mg      | %     | 427         | 0.26 | 0.22   | 0.21 | 0.23           | 0.03     | 0.17               | 0.03    | 1.64    | 1.61  | 0.87         | 0.57 | 0.41 | 0.29 | 0.22 | 0.17 | 0.15 | 0.12 |
| Mn      | ppm   | 427         | 134  | 124    | 127  | 125            | 2904.53  | 53.89              | 49      | 512     | 463   | 335          | 236  | 197  | 149  | 124  | 102  | 85   | 65   |
| Mo      | ppm   | 427         | 1.3  | 1.0    | 0.5  | 1.0            | 1.29     | 1.14               | 0.5     | 9.0     | 8.5   | 4.0          | 3.0  | 3.0  | 2.0  | 1.0  | 0.5  | 0.5  | 0.5  |
| Na      | %     | 427         | 0.04 | 0.04   | 0.05 | 0.03           | 0.00     | 0.02               | 0.01    | 0.08    | 0.07  | 0.07         | 0.06 | 0.06 | 0.05 | 0.04 | 0.02 | 0.02 | 0.02 |
| Ni      | ppm   | 427         | 38   | 28     | 24   | 31             | 2294.54  | 47.90              | 12      | 683     | 671   | 225          | 75   | 54   | 38   | 28   | 22   | 17   | 12   |
| Pb      | ppm   | 427         | 11   | 9      | 5    | 9              | 56.97    | 7.55               | 1       | 53      | 52    | 33           | 24   | 21   | 17   | 9    | 5    | 4    | 3    |
| Pd      | ppb   | 427         | 0.9  | 0.3    | 0.3  | 0.3            | 34.71    | 5.89               | 0.3     | 98.6    | 98.3  | 4.7          | 1.2  | 0.8  | 0.3  | 0.3  | 0.3  | 0.3  | 0.3  |
| Pt      | ppb   | 427         | 1.1  | 0.5    | 0.1  | 0.5            | 48.95    | 7.00               | 0.1     | 126.6   | 126.5 | 6.5          | 1.2  | 0.9  | 0.6  | 0.5  | 0.4  | 0.4  | 0.4  |
| Sb      | ppm   | 428         | 0.2  | 0.2    | 0.1  | 0.2            | 0.07     | 0.3                | 0.05    | 2.9     | 2.9   | 1.4          | 0.6  | 0.4  | 0.3  | 0.2  | 0.1  | 0.1  | 0.1  |
| Se      | ppm   | 427         | 2.5  | 2.5    | 2.5  | 2.5            | 0.01     | 0.12               | 2.5     | 5.0     | 2.5   | 2.5          | 2.5  | 2.5  | 2.5  | 2.5  | 2.5  | 2.5  | 2.5  |
| Se      | ppm   | 428         | 0.3  | 0.2    | 0.1  | 0.2            | 0.24     | 0.5                | 0.05    | 8.2     | 8.2   | 1.2          | 0.6  | 0.5  | 0.3  | 0.2  | 0.05 | 0.05 | 0.05 |
| Sn      | ppm   | 427         | 11   | 10     | 10   | 10             | 28.54    | 5.34               | 10      | 85      | 75    | 22           | 10   | 10   | 10   | 10   | 10   | 10   | 10   |
| Sr      | ppm   | 427         | 10   | 9      | 8    | 10             | 8.89     | 2.98               | 5       | 23      | 19    | 19           | 16   | 15   | 11   | 9    | 8    | 7    | 5    |
| Te      | ppm   | 428         | 0.1  | 0.1    | 0.1  | 0.1            | 0.01     | 0.1                | 0.05    | 0.9     | 0.9   | 0.6          | 0.4  | 0.3  | 0.2  | 0.1  | 0.05 | 0.05 | 0.05 |
| V       | ppm   | 427         | 39   | 37     | 36   | 38             | 178.78   | 13.37              | 20      | 180     | 160   | 84           | 58   | 51   | 42   | 37   | 32   | 27   | 22   |
| W       | ppm   | 427         | 10   | 10     | 10   | 10             | 0.28     | 0.53               | 10      | 21      | 11    | 10           | 10   | 10   | 10   | 10   | 10   | 10   | 10   |
| Y       | ppm   | 427         | 2.7  | 2.0    | 2.0  | 2.5            | 1.09     | 1.04               | 0.5     | 10.0    | 9.5   | 7.0          | 5.0  | 4.0  | 3.0  | 2.0  | 2.0  | 2.0  | 2.0  |
| Zn      | ppm   | 427         | 48   | 43     | 42   | 43             | 679.56   | 26.07              | 12      | 260     | 248   | 150          | 92   | 79   | 56   | 43   | 32   | 27   | 22   |

Appendix K. Summary statistics for B-horizon till (hydroxylamine hydrochloride digestion).

| Element | Units | Sample Size | Mean | Median | Mode | Geometric Mean | Variance | Standard Deviation | Minimum | Maximum | Range | Percentiles: |      |      |      |      |
|---------|-------|-------------|------|--------|------|----------------|----------|--------------------|---------|---------|-------|--------------|------|------|------|------|
|         |       |             |      |        |      |                |          |                    |         |         |       | 99           | 95   | 90   | 75   | 25   |
| Ag      | ppm   | 427         | 0.1  | 0.1    | 0.1  | 0.1            | 0.05     | 0.23               | 0.1     | 4.0     | 4.0   | 0.2          | 0.1  | 0.1  | 0.1  | 0.1  |
| Al      | %     | 427         | 1.01 | 0.98   | 0.86 | 0.95           | 0.10     | 0.32               | 0.01    | 2.63    | 2.63  | 1.88         | 1.59 | 1.44 | 1.18 | 0.98 |
| As      | ppm   | 427         | 2    | 2      | 2    | 2              | 0.00     | 0.00               | 2       | 2       | 2     | 2            | 2    | 2    | 2    | 2    |
| Ba      | ppm   | 427         | 11   | 8      | 6    | 9              | 105.93   | 10.29              | 1       | 93      | 93    | 58           | 28   | 20   | 13   | 8    |
| Be      | ppm   | 427         | 0.26 | 0.25   | 0.25 | 0.25           | 0.00     | 0.04               | 0.25    | 0.70    | 0.45  | 0.50         | 0.25 | 0.25 | 0.25 | 0.25 |
| Bi      | ppm   | 427         | 2    | 2      | 2    | 2              | 0.54     | 0.73               | 2       | 5       | 4     | 4            | 4    | 3    | 2    | 2    |
| Ca      | %     | 427         | 0.01 | 0.01   | 0.01 | 0.01           | 0.00     | 0.01               | 0.01    | 0.09    | 0.09  | 0.06         | 0.03 | 0.02 | 0.01 | 0.01 |
| Cd      | ppm   | 427         | 1    | 1      | 1    | 1              | 0.00     | 0.00               | 1       | 1       | 1     | 1            | 1    | 1    | 1    | 1    |
| Co      | ppm   | 427         | 1    | 1      | 1    | 1              | 1.32     | 1.15               | 1       | 14      | 14    | 5            | 3    | 2    | 2    | 1    |
| Cr      | ppm   | 427         | 9    | 8      | 8    | 8              | 23.01    | 4.80               | 1       | 72      | 72    | 24           | 15   | 13   | 10   | 8    |
| Cu      | ppm   | 427         | 6.8  | 3.1    | 2.3  | 3.6            | 249.01   | 15.78              | 0.3     | 151.0   | 150.8 | 94.3         | 18.4 | 10.9 | 5.4  | 3.1  |
| Fe      | %     | 427         | 0.71 | 0.66   | 0.65 | 0.66           | 0.08     | 0.28               | 0.01    | 2.66    | 2.66  | 1.58         | 1.21 | 1.03 | 0.83 | 0.66 |
| K       | %     | 427         | 0.01 | 0.01   | 0.01 | 0.01           | 0.00     | 0.00               | 0.01    | 0.01    | 0.01  | 0.01         | 0.01 | 0.01 | 0.01 | 0.01 |
| La      | ppm   | 427         | 2.6  | 2.1    | 2.1  | 2.2            | 4.04     | 2.01               | 0.3     | 23.7    | 23.5  | 10.5         | 5.7  | 4.3  | 2.9  | 2.1  |
| Li      | ppm   | 197         | 1    | 1      | 1    | 1              | 1.15     | 1.07               | 1       | 9       | 9     | 7            | 3    | 2    | 1    | 1    |
| Mg      | %     | 427         | 0.03 | 0.02   | 0.01 | 0.02           | 0.00     | 0.04               | 0.01    | 0.34    | 0.34  | 0.19         | 0.10 | 0.07 | 0.03 | 0.02 |
| Mn      | ppm   | 427         | 15   | 9      | 4    | 9              | 380.89   | 19.52              | 1       | 188     | 187   | 104          | 49   | 31   | 16   | 9    |
| Mo      | ppm   | 427         | 1    | 1      | 1    | 1              | 0.01     | 0.08               | 1       | 2       | 2     | 1            | 1    | 1    | 1    | 1    |
| Na      | %     | 230         | 0.51 | 0.45   | 0.45 | 0.46           | 0.06     | 0.24               | 0.17    | 1.73    | 1.56  | 1.31         | 0.96 | 0.83 | 0.62 | 0.45 |
| Ni      | ppm   | 427         | 5    | 4      | 3    | 4              | 43.50    | 6.60               | 1       | 101     | 101   | 32           | 11   | 8    | 6    | 4    |
| P       | %     | 427         | 0.01 | 0.01   | 0.01 | 0.01           | 0.00     | 0.01               | 0.01    | 0.10    | 0.10  | 0.07         | 0.04 | 0.03 | 0.01 | 0.01 |
| Pb      | ppm   | 427         | 2    | 1      | 1    | 1              | 2.58     | 1.61               | 1       | 13      | 12    | 8            | 5    | 4    | 2    | 1    |
| Sb      | ppm   | 427         | 3    | 3      | 3    | 3              | 0.00     | 0.00               | 3       | 3       | 3     | 3            | 3    | 3    | 3    | 3    |
| Sc      | ppm   | 427         | 0.3  | 0.3    | 0.3  | 0.3            | 0.00     | 0.00               | 0.3     | 0.3     | 0.0   | 0.3          | 0.3  | 0.3  | 0.3  | 0.3  |
| Sn      | ppm   | 427         | 5    | 5      | 5    | 5              | 0.00     | 0.00               | 5       | 5       | 5     | 5            | 5    | 5    | 5    | 5    |
| Sr      | ppm   | 427         | 0.4  | 0.3    | 0.3  | 0.4            | 0.12     | 0.35               | 0.3     | 4.1     | 3.9   | 1.6          | 1.1  | 0.8  | 0.6  | 0.3  |
| Ta      | ppm   | 427         | 1    | 1      | 1    | 1              | 0.05     | 0.22               | 1       | 2       | 2     | 2            | 1    | 1    | 1    | 1    |
| Ti      | %     | 427         | 0.01 | 0.01   | 0.01 | 0.01           | 0.00     | 0.00               | 0.01    | 0.02    | 0.02  | 0.02         | 0.01 | 0.01 | 0.01 | 0.01 |
| V       | ppm   | 427         | 10   | 9      | 8    | 9              | 17.12    | 4.14               | 1       | 31      | 30    | 24           | 18   | 15   | 12   | 9    |
| W       | ppm   | 427         | 5    | 5      | 5    | 5              | 0.00     | 0.00               | 5       | 5       | 5     | 5            | 5    | 5    | 5    | 5    |
| Y       | ppm   | 427         | 1.0  | 0.8    | 0.7  | 0.9            | 0.47     | 0.69               | 0.1     | 5.9     | 5.9   | 3.8          | 2.2  | 1.7  | 1.1  | 0.8  |
| Zn      | ppm   | 427         | 6.7  | 5.6    | 4.0  | 5.6            | 19.90    | 4.46               | 0.3     | 35.9    | 35.7  | 23.4         | 14.8 | 11.7 | 8.6  | 5.6  |
| Zr      | ppm   | 427         | 0.6  | 0.6    | 0.3  | 0.5            | 0.13     | 0.36               | 0.3     | 2.9     | 2.7   | 1.6          | 1.2  | 1.0  | 0.8  | 0.6  |



Appendix K. Summary statistics for C-horizon till (aqua regia digestion).

| Element | Units | Sample Size | Mean | Median | Mode | Geometric Mean | Variance | Standard Deviation | Minimum | Maximum | Range | Percentiles: |      |      |      |      |      |
|---------|-------|-------------|------|--------|------|----------------|----------|--------------------|---------|---------|-------|--------------|------|------|------|------|------|
|         |       |             |      |        |      |                |          |                    |         |         |       | 99           | 95   | 90   | 75   | 50   | 25   |
| Ag      | ppm   | 431         | 0.2  | 0.1    | 0.1  | 0.2            | 0.02     | 0.15               | 0.1     | 1.3     | 1.2   | 0.6          | 0.5  | 0.4  | 0.3  | 0.1  | 0.1  |
| Al      | %     | 431         | 1.44 | 1.31   | 1.75 | 1.31           | 0.43     | 0.66               | 0.32    | 5.39    | 5.07  | 3.68         | 2.50 | 2.22 | 1.75 | 1.31 | 0.96 |
| As      | ppm   | 431         | 3.5  | 2.3    | 1.4  | 2.5            | 18.1     | 4.3                | 0.3     | 37.1    | 36.8  | 22.9         | 10.3 | 7.1  | 3.5  | 2.3  | 1.5  |
| Au      | ppb   | 426         | 7.0  | 2.3    | 0.5  | 2.5            | 322.60   | 17.96              | 0.5     | 243.3   | 242.8 | 87.3         | 29.5 | 14.6 | 5.3  | 2.3  | 0.5  |
| Ba      | ppm   | 431         | 41   | 35     | 26   | 36             | 648.22   | 25.46              | 8       | 307     | 299   | 118          | 89   | 69   | 50   | 35   | 25   |
| Bi      | ppm   | 431         | 0.2  | 0.2    | 0.1  | 0.2            | 0.0      | 0.2                | 0.05    | 0.9     | 0.9   | 0.7          | 0.6  | 0.5  | 0.3  | 0.2  | 0.1  |
| Ca      | %     | 431         | 0.34 | 0.30   | 0.26 | 0.31           | 0.03     | 0.17               | 0.05    | 2.43    | 2.38  | 0.82         | 0.61 | 0.54 | 0.39 | 0.30 | 0.25 |
| Cd      | ppm   | 431         | 0.3  | 0.1    | 0.1  | 0.2            | 0.08     | 0.28               | 0.1     | 1.7     | 1.6   | 1.1          | 0.8  | 0.7  | 0.5  | 0.1  | 0.1  |
| Co      | ppm   | 431         | 14   | 12     | 9    | 13             | 89.49    | 9.46               | 1       | 130     | 130   | 50           | 28   | 23   | 17   | 12   | 9    |
| Cr      | ppm   | 431         | 45   | 38     | 27   | 39             | 1420.56  | 37.69              | 9       | 491     | 482   | 205          | 91   | 71   | 50   | 38   | 28   |
| Cu      | ppm   | 431         | 62   | 34     | 22   | 37             | 15315.00 | 123.75             | 1       | 1500    | 1499  | 682          | 193  | 86   | 53   | 34   | 22   |
| Fe      | %     | 431         | 2.23 | 2.03   | 2.24 | 2.09           | 0.82     | 0.90               | 0.52    | 10.00   | 9.48  | 5.49         | 3.72 | 3.11 | 2.57 | 2.03 | 1.65 |
| Ge      | ppm   | 431         | 0.1  | 0.1    | 0.1  | 0.1            | 0.0      | 0.1                | 0.05    | 0.8     | 0.8   | 0.6          | 0.5  | 0.3  | 0.2  | 0.05 | 0.05 |
| K       | %     | 431         | 0.08 | 0.06   | 0.05 | 0.07           | 0.00     | 0.04               | 0.02    | 0.29    | 0.27  | 0.24         | 0.16 | 0.13 | 0.08 | 0.06 | 0.05 |
| La      | ppm   | 431         | 20   | 17     | 18   | 19             | 94.03    | 9.70               | 5       | 72      | 67    | 54           | 39   | 32   | 24   | 17   | 14   |
| Mg      | %     | 431         | 0.55 | 0.45   | 0.35 | 0.47           | 0.17     | 0.42               | 0.03    | 4.30    | 4.27  | 2.70         | 1.08 | 0.89 | 0.62 | 0.45 | 0.34 |
| Mn      | ppm   | 431         | 248  | 213    | 140  | 222            | 24331    | 156                | 41      | 1833    | 1792  | 1030         | 438  | 363  | 279  | 213  | 170  |
| Mo      | ppm   | 431         | 1.1  | 0.5    | 0.5  | 0.8            | 2.03     | 1.42               | 0.5     | 23.0    | 22.5  | 4.0          | 3.0  | 2.0  | 1.0  | 0.5  | 0.5  |
| Na      | %     | 431         | 0.05 | 0.04   | 0.03 | 0.04           | 0.00     | 0.02               | 0.02    | 0.11    | 0.09  | 0.10         | 0.09 | 0.08 | 0.06 | 0.04 | 0.03 |
| Ni      | ppm   | 431         | 44   | 29     | 23   | 31             | 7667.88  | 87.57              | 2       | 1511    | 1509  | 254          | 97   | 64   | 41   | 29   | 22   |
| Pb      | ppm   | 431         | 13   | 12     | 14   | 10             | 80.25    | 8.96               | 1       | 83      | 82    | 52           | 27   | 21   | 15   | 12   | 7    |
| Pd      | ppb   | 426         | 1.2  | 0.3    | 0.3  | 0.4            | 63.02    | 7.94               | 0.3     | 159.8   | 159.6 | 13.3         | 3.2  | 1.6  | 0.7  | 0.3  | 0.3  |
| Pt      | ppb   | 426         | 1.2  | 0.8    | 0.1  | 0.9            | 3.59     | 1.90               | 0.1     | 24.9    | 24.8  | 9.2          | 2.8  | 1.8  | 1.1  | 0.8  | 0.6  |
| Sb      | ppm   | 431         | 0.2  | 0.1    | 0.1  | 0.1            | 0.0      | 0.2                | 0.05    | 1.6     | 1.6   | 1.1          | 0.5  | 0.3  | 0.2  | 0.1  | 0.05 |
| Sc      | ppm   | 431         | 2.7  | 2.5    | 2.5  | 2.6            | 0.97     | 0.98               | 2.5     | 10.0    | 7.5   | 8.0          | 5.0  | 2.5  | 2.5  | 2.5  | 2.5  |
| Se      | ppm   | 431         | 0.2  | 0.1    | 0.1  | 0.1            | 0.0      | 0.0                | 0.05    | 3.6     | 3.6   | 0.7          | 0.4  | 0.3  | 0.2  | 0.1  | 0.05 |
| Sn      | ppm   | 431         | 10   | 10     | 10   | 10             | 22.85    | 4.78               | 10      | 105     | 95    | 20           | 10   | 10   | 10   | 10   | 10   |
| Sr      | ppm   | 431         | 19   | 18     | 16   | 18             | 53.49    | 7.31               | 6       | 54      | 48    | 42           | 34   | 30   | 22   | 18   | 14   |
| Te      | ppm   | 431         | 0.1  | 0.1    | 0.1  | 0.1            | 0.0      | 0.1                | 0.05    | 0.4     | 0.4   | 0.3          | 0.2  | 0.2  | 0.1  | 0.1  | 0.05 |
| V       | ppm   | 431         | 41   | 37     | 32   | 39             | 228.35   | 15.11              | 17      | 123     | 106   | 95           | 70   | 58   | 47   | 37   | 31   |
| W       | ppm   | 431         | 10   | 10     | 10   | 10             | 0.00     | 0.00               | 10      | 10      | 0     | 10           | 10   | 10   | 10   | 10   | 10   |
| Y       | ppm   | 431         | 6.1  | 5.0    | 5.0  | 5.7            | 5.59     | 2.36               | 0.5     | 18.0    | 17.5  | 14.0         | 11.0 | 9.0  | 7.0  | 5.0  | 4.0  |
| Zn      | ppm   | 431         | 37   | 29     | 21   | 30             | 1248.93  | 35.34              | 3       | 472     | 469   | 144          | 82   | 61   | 42   | 29   | 20   |



Appendix K. Summary statistics for C-horizon till (hydroxylamine hydrochloride digestion).

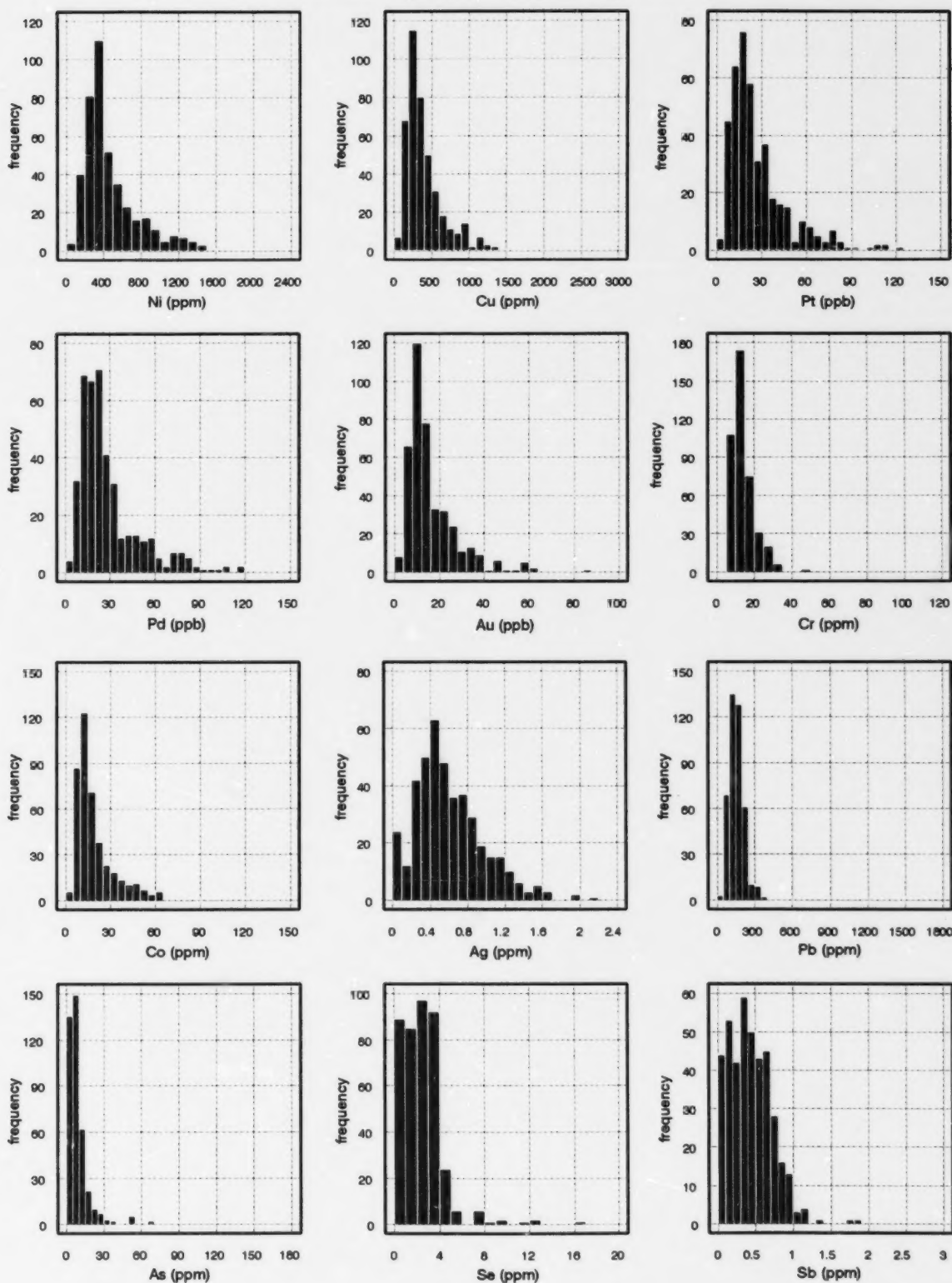
| Element | Units | Sample Size | Mean | Median | Mode | Geometric Mean | Variance | Standard Deviation | Minimum | Maximum | Range | Percentiles: |      |      |      |      |      |
|---------|-------|-------------|------|--------|------|----------------|----------|--------------------|---------|---------|-------|--------------|------|------|------|------|------|
|         |       |             |      |        |      |                |          |                    |         |         |       | 99           | 95   | 90   | 75   | 50   | 25   |
| Ag      | ppm   | 429         | 0.1  | 0.1    | 0.1  | 0.1            | 0.00     | 0.02               | 0.1     | 0.4     | 0.4   | 0.1          | 0.1  | 0.1  | 0.1  | 0.1  | 0.1  |
| Al      | %     | 429         | 0.50 | 0.43   | 0.21 | 0.43           | 0.08     | 0.29               | 0.08    | 2.64    | 2.56  | 1.39         | 1.01 | 0.86 | 0.64 | 0.43 | 0.29 |
| As      | ppm   | 429         | 2    | 2      | 2    | 2              | 1.30     | 1.14               | 2       | 14      | 13    | 9            | 2    | 2    | 2    | 2    | 2    |
| Ba      | ppm   | 429         | 8    | 6      | 5    | 7              | 117.46   | 10.84              | 2       | 206     | 204   | 33           | 18   | 14   | 9    | 6    | 5    |
| Be      | ppm   | 429         | 0.25 | 0.25   | 0.25 | 0.25           | 0.00     | 0.04               | 0.25    | 0.60    | 0.35  | 0.50         | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 |
| Bi      | ppm   | 429         | 2    | 2      | 2    | 2              | 0.00     | 0.00               | 2       | 2       | 0     | 2            | 2    | 2    | 2    | 2    | 2    |
| Ca      | %     | 429         | 0.08 | 0.07   | 0.06 | 0.06           | 0.00     | 0.05               | 0.01    | 0.42    | 0.42  | 0.24         | 0.18 | 0.15 | 0.10 | 0.07 | 0.05 |
| Cd      | ppm   | 429         | 1    | 1      | 1    | 1              | 0.01     | 0.12               | 1       | 3       | 3     | 1            | 1    | 1    | 1    | 1    | 1    |
| Co      | ppm   | 429         | 4    | 3      | 2    | 3              | 17.75    | 4.21               | 1       | 72      | 72    | 16           | 9    | 6    | 5    | 3    | 2    |
| Cr      | ppm   | 429         | 9    | 7      | 4    | 7              | 6473.22  | 7.83               | 1       | 98      | 97    | 34           | 17   | 15   | 11   | 7    | 5    |
| Cu      | ppm   | 429         | 20.1 | 12.5   | 6.9  | 13.2           | 1121.63  | 33.49              | 0.5     | 386.0   | 385.5 | 157.0        | 57.4 | 31.4 | 19.6 | 12.5 | 7.9  |
| Fe      | %     | 429         | 0.46 | 0.40   | 0.41 | 0.41           | 0.08     | 0.28               | 0.05    | 3.99    | 3.94  | 1.21         | 0.89 | 0.71 | 0.55 | 0.40 | 0.30 |
| K       | %     | 429         | 0.01 | 0.01   | 0.01 | 0.01           | 0.00     | 0.01               | 0.01    | 0.06    | 0.06  | 0.03         | 0.02 | 0.01 | 0.01 | 0.01 | 0.01 |
| La      | ppm   | 429         | 6.6  | 5.1    | 4.3  | 5.4            | 21.75    | 4.66               | 0.3     | 29.1    | 28.9  | 24.6         | 15.7 | 12.5 | 8.1  | 5.1  | 3.5  |
| Li      | ppm   | 221         | 2    | 1      | 1    | 1              | 1.52     | 1.23               | 1       | 7       | 7     | 6            | 4    | 3    | 2    | 1    | 1    |
| Mg      | %     | 429         | 0.10 | 0.08   | 0.05 | 0.08           | 0.01     | 0.08               | 0.01    | 1.05    | 1.05  | 0.42         | 0.21 | 0.17 | 0.11 | 0.08 | 0.06 |
| Mn      | ppm   | 429         | 66   | 49     | 39   | 47             | 6473.22  | 80.46              | 1       | 943     | 942   | 449          | 149  | 119  | 78   | 49   | 28   |
| Mo      | ppm   | 429         | 1    | 1      | 1    | 1              | 0.00     | 0.00               | 1       | 1       | 0     | 1            | 1    | 1    | 1    | 1    | 1    |
| Na      | %     | 208         | 0.48 | 0.44   | 0.28 | 0.44           | 0.05     | 0.22               | 0.14    | 1.23    | 1.09  | 1.12         | 0.98 | 0.80 | 0.59 | 0.44 | 0.32 |
| Ni      | ppm   | 429         | 11   | 6      | 4    | 6              | 1462.64  | 38.24              | 1       | 762     | 762   | 83           | 24   | 14   | 9    | 6    | 4    |
| P       | %     | 429         | 0.04 | 0.03   | 0.03 | 0.03           | 0.00     | 0.02               | 0.01    | 0.18    | 0.18  | 0.11         | 0.08 | 0.07 | 0.05 | 0.03 | 0.02 |
| Pb      | ppm   | 429         | 5    | 4      | 3    | 4              | 21.33    | 4.62               | 1       | 43      | 42    | 28           | 12   | 10   | 6    | 4    | 3    |
| Sb      | ppm   | 429         | 3    | 3      | 3    | 3              | 0.00     | 0.00               | 3       | 3       | 0     | 3            | 3    | 3    | 3    | 3    | 3    |
| Sc      | ppm   | 429         | 0.3  | 0.3    | 0.3  | 0.3            | 0.01     | 0.10               | 0.3     | 1.4     | 1.2   | 0.8          | 0.3  | 0.3  | 0.3  | 0.3  | 0.3  |
| Sn      | ppm   | 429         | 5    | 5      | 5    | 5              | 0.00     | 0.00               | 5       | 5       | 0     | 5            | 5    | 5    | 5    | 5    | 5    |
| Sr      | ppm   | 429         | 1.6  | 1.6    | 1.8  | 1.4            | 0.64     | 0.80               | 0.3     | 6.4     | 6.2   | 4.2          | 3.0  | 2.5  | 2.0  | 1.6  | 1.1  |
| Ta      | ppm   | 429         | 1    | 1      | 1    | 1              | 0.04     | 0.20               | 1       | 2       | 2     | 2            | 1    | 1    | 1    | 1    | 1    |
| Ti      | %     | 429         | 0.01 | 0.01   | 0.01 | 0.01           | 0.00     | 0.01               | 0.01    | 0.04    | 0.04  | 0.03         | 0.02 | 0.02 | 0.02 | 0.01 | 0.01 |
| V       | ppm   | 429         | 9    | 8      | 7    | 8              | 61.33    | 4.97               | 1       | 45      | 44    | 24           | 17   | 15   | 11   | 8    | 6    |
| W       | ppm   | 429         | 5    | 5      | 5    | 5              | 0.00     | 0.00               | 5       | 5       | 0     | 5            | 5    | 5    | 5    | 5    | 5    |
| Y       | ppm   | 429         | 2.4  | 2.1    | 1.6  | 2.1            | 1.87     | 1.37               | 0.1     | 11.7    | 11.7  | 7.5          | 4.9  | 3.9  | 2.9  | 2.1  | 1.5  |
| Zn      | ppm   | 429         | 8.7  | 6.6    | 5.2  | 6.8            | 77.89    | 8.83               | 0.3     | 119.0   | 118.8 | 43.0         | 21.0 | 14.7 | 10.3 | 6.6  | 4.1  |
| Zr      | ppm   | 429         | 0.7  | 0.7    | 0.3  | 0.6            | 0.15     | 0.39               | 0.3     | 2.6     | 2.4   | 1.8          | 1.3  | 1.2  | 0.9  | 0.7  | 0.3  |

Appendix K. Summary statistics for the non-magnetic HMC fraction of C-horizon till (aqua regia digestion).

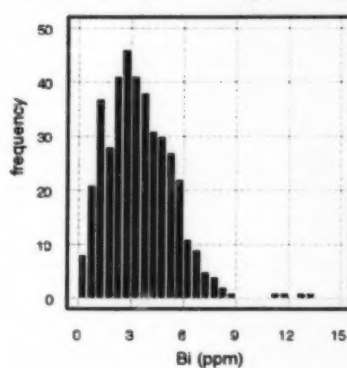
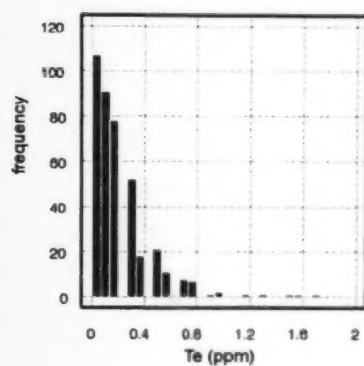
| Element | Units | Sample Size | Mean  | Median | Mode  | Geometric Mean | Variance | Standard Deviation | Minimum | Maximum | Range   | Percentiles: |       |       |       |      |
|---------|-------|-------------|-------|--------|-------|----------------|----------|--------------------|---------|---------|---------|--------------|-------|-------|-------|------|
|         |       |             |       |        |       |                |          |                    |         |         |         | 99           | 95    | 90    | 75    | 50   |
| Ag      | ppm   | 373         | 0.6   | 0.4    | 0.4   | 0.4            | 2.2      | 1.5                | 0.1     | 26.1    | 26.0    | 4.1          | 1.1   | 0.7   | 0.6   | 0.4  |
| As      | ppm   | 271         | 4.8   | 3.3    | 0.1   | 2.8            | 212.5    | 14.6               | 0.1     | 238.6   | 238.6   | 17.1         | 9.8   | 7.7   | 4.9   | 3.3  |
| Au      | ppb   | 271         | 346.7 | 101.0  | 0.5   | 91.9           | 873317.0 | 934.5              | 0.5     | 10339.0 | 10338.5 | 5118         | 1229  | 626   | 293   | 101  |
| Ba      | ppm   | 373         | 39    | 25     | 23    | 29             | 2395     | 49                 | 9       | 424     | 415     | 260          | 127   | 72    | 33    | 25   |
| Bi      | ppm   | 271         | 0.5   | 0.4    | 0.1   | 0.3            | 0.2      | 0.4                | 0.1     | 1.8     | 1.8     | 1.7          | 1.3   | 1     | 0.7   | 0.4  |
| Ca      | %     | 373         | 1.6   | 1.5    | 1.3   | 1.5            | 0.4      | 0.6                | 0.4     | 5.1     | 4.7     | 3.79         | 2.7   | 2.33  | 1.87  | 1.49 |
| Cd      | ppm   | 373         | 0.1   | 0.1    | 0.1   | 0.1            | 0.0      | 0.1                | 0.1     | 0.4     | 0.3     | 0.4          | 0.3   | 0.1   | 0.1   | 0.1  |
| Co      | ppm   | 373         | 51    | 41     | 41    | 43             | 2012     | 45                 | 8       | 462     | 454     | 284          | 106   | 81    | 57    | 41   |
| Cr      | ppm   | 373         | 75    | 69     | 51    | 67             | 1178     | 34                 | 11      | 190     | 179     | 168          | 144   | 122   | 96    | 69   |
| Cu      | ppm   | 373         | 44    | 34     | 34    | 37             | 1742     | 42                 | 12      | 477     | 465     | 297          | 100   | 63    | 46    | 34   |
| Fe      | %     | 373         | 9.10  | 8.91   | 10.97 | 8.76           | 6.02     | 2.45               | 3.04    | 17.86   | 14.82   | 14.62        | 13.34 | 12.35 | 10.82 | 8.91 |
| Ge      | ppm   | 271         | 0.10  | 0.05   | 0.05  | 0.08           | 0.00     | 0.07               | 0.05    | 0.40    | 0.35    | 0.3          | 0.2   | 0.2   | 0.1   | 0.05 |
| K       | %     | 373         | 0.05  | 0.05   | 0.04  | 0.05           | 0.00     | 0.02               | 0.02    | 0.19    | 0.17    | 0.18         | 0.09  | 0.07  | 0.06  | 0.05 |
| La      | ppm   | 373         | 143   | 118    | 97    | 125            | 10825    | 104                | 40      | 1223    | 1183    | 573          | 303   | 209   | 156   | 118  |
| Mg      | %     | 373         | 1.7   | 1.6    | 1.4   | 1.6            | 0.4      | 0.7                | 0.2     | 4.1     | 3.8     | 3.94         | 3.16  | 2.58  | 1.99  | 1.55 |
| Mn      | ppm   | 373         | 1351  | 1206   | 788   | 1236           | 344813   | 587                | 305     | 3888    | 3583    | 3200         | 2401  | 2205  | 1687  | 1206 |
| Mo      | ppm   | 373         | 5     | 5      | 4     | 5              | 1        | 1                  | 2       | 8       | 6       | 8            | 7     | 6     | 6     | 5    |
| Na      | %     | 373         | 0.03  | 0.02   | 0.02  | 0.03           | 0.00     | 0.01               | 0.01    | 0.13    | 0.12    | 0.06         | 0.04  | 0.04  | 0.03  | 0.02 |
| Ni      | ppm   | 373         | 39    | 34     | 30    | 35             | 514      | 23                 | 4       | 208     | 204     | 120          | 78    | 65    | 45    | 34   |
| Pb      | ppm   | 373         | 21    | 17     | 17    | 17             | 409      | 20                 | 1       | 306     | 305     | 100          | 37    | 31    | 23    | 17   |
| Pd      | ppb   | 271         | 7.5   | 3.0    | 0.5   | 2.7            | 988.6    | 31.4               | 0.5     | 489.0   | 488.5   | 84           | 18    | 13    | 7     | 3    |
| Pt      | ppb   | 271         | 7.8   | 3.0    | 0.5   | 2.7            | 1252.7   | 35.4               | 0.5     | 562.0   | 561.5   | 82           | 25    | 10    | 6     | 3    |
| Sb      | ppm   | 271         | 0.4   | 0.3    | 0.3   | 0.3            | 0.1      | 0.3                | 0.1     | 2.8     | 2.8     | 1.2          | 0.7   | 0.6   | 0.4   | 0.3  |
| Sc      | ppm   | 373         | 10.8  | 10.0   | 8.0   | 10.0           | 20.1     | 4.5                | 2.5     | 42.0    | 39.5    | 25           | 18    | 16    | 13    | 10   |
| Se      | ppm   | 271         | 0.15  | 0.10   | 0.05  | 0.11           | 0.03     | 0.17               | 0.05    | 1.90    | 1.85    | 0.8          | 0.4   | 0.3   | 0.2   | 0.1  |
| Sn      | ppm   | 373         | 10.1  | 10.0   | 10.0  | 10.0           | 0.8      | 0.9                | 10.0    | 23.0    | 13.0    | 10           | 10    | 10    | 10    | 10   |
| Sr      | ppm   | 373         | 135   | 120    | 104   | 120            | 5657     | 75                 | 9       | 675     | 666     | 519          | 237   | 197   | 154   | 120  |
| Te      | ppm   | 271         | 0.12  | 0.10   | 0.05  | 0.10           | 0.01     | 0.09               | 0.05    | 0.50    | 0.45    | 0.4          | 0.3   | 0.2   | 0.2   | 0.1  |
| V       | ppm   | 373         | 128   | 119    | 121   | 119            | 12722    | 113                | 35      | 2192    | 2157    | 220          | 188   | 172   | 145   | 119  |
| W       | ppm   | 373         | 10    | 10     | 10    | 10             | 3        | 2                  | 10      | 37      | 27      | 10           | 10    | 10    | 10    | 10   |
| Y       | ppm   | 373         | 29    | 28     | 22    | 27             | 145      | 12                 | 3       | 76      | 73      | 70           | 53    | 44    | 36    | 28   |
| Zn      | ppm   | 373         | 73    | 64     | 52    | 69             | 869      | 29                 | 29      | 200     | 171     | 181          | 137   | 111   | 85    | 64   |

**Appendix L. Frequency histograms of geochemistry for the 7 geochemical datasets.**

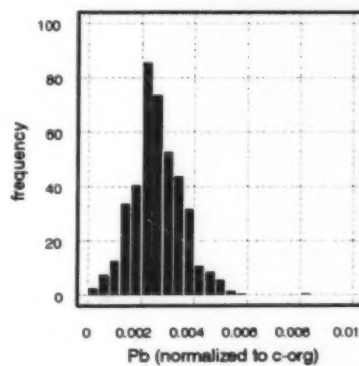
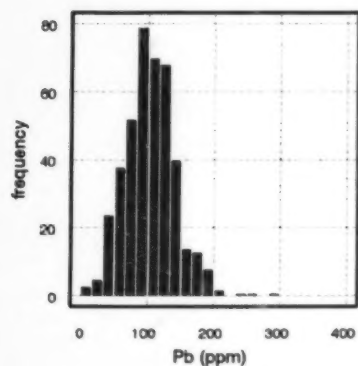
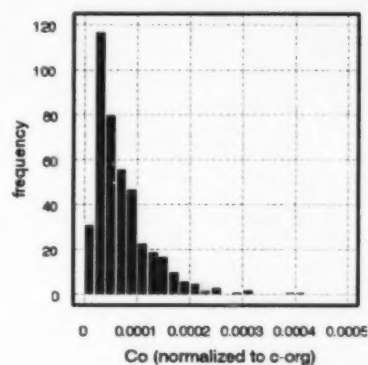
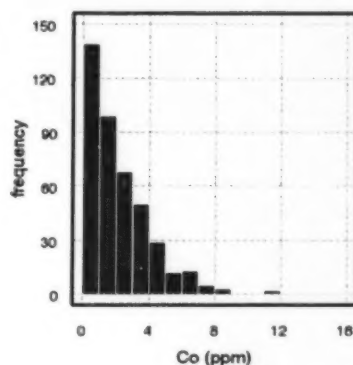
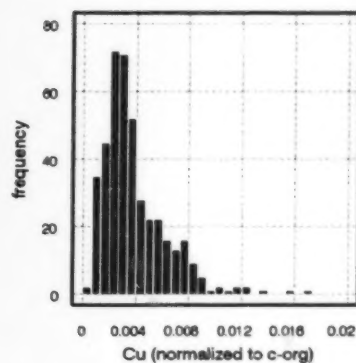
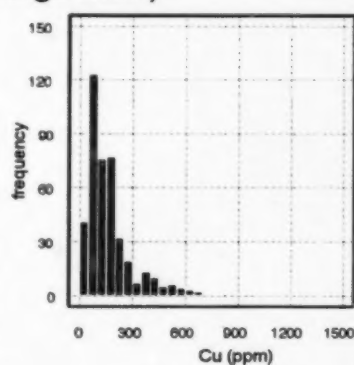
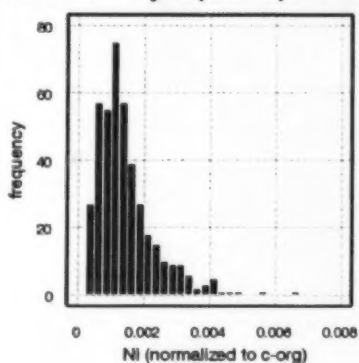
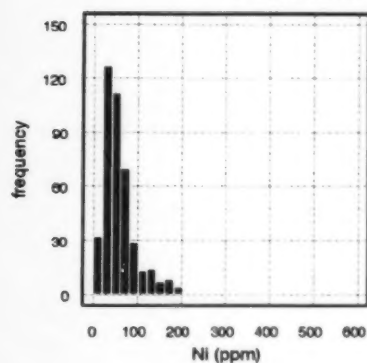
# HUMUS (Aqua Regia Digestion)



## HUMUS (Aqua Regia Digestion)

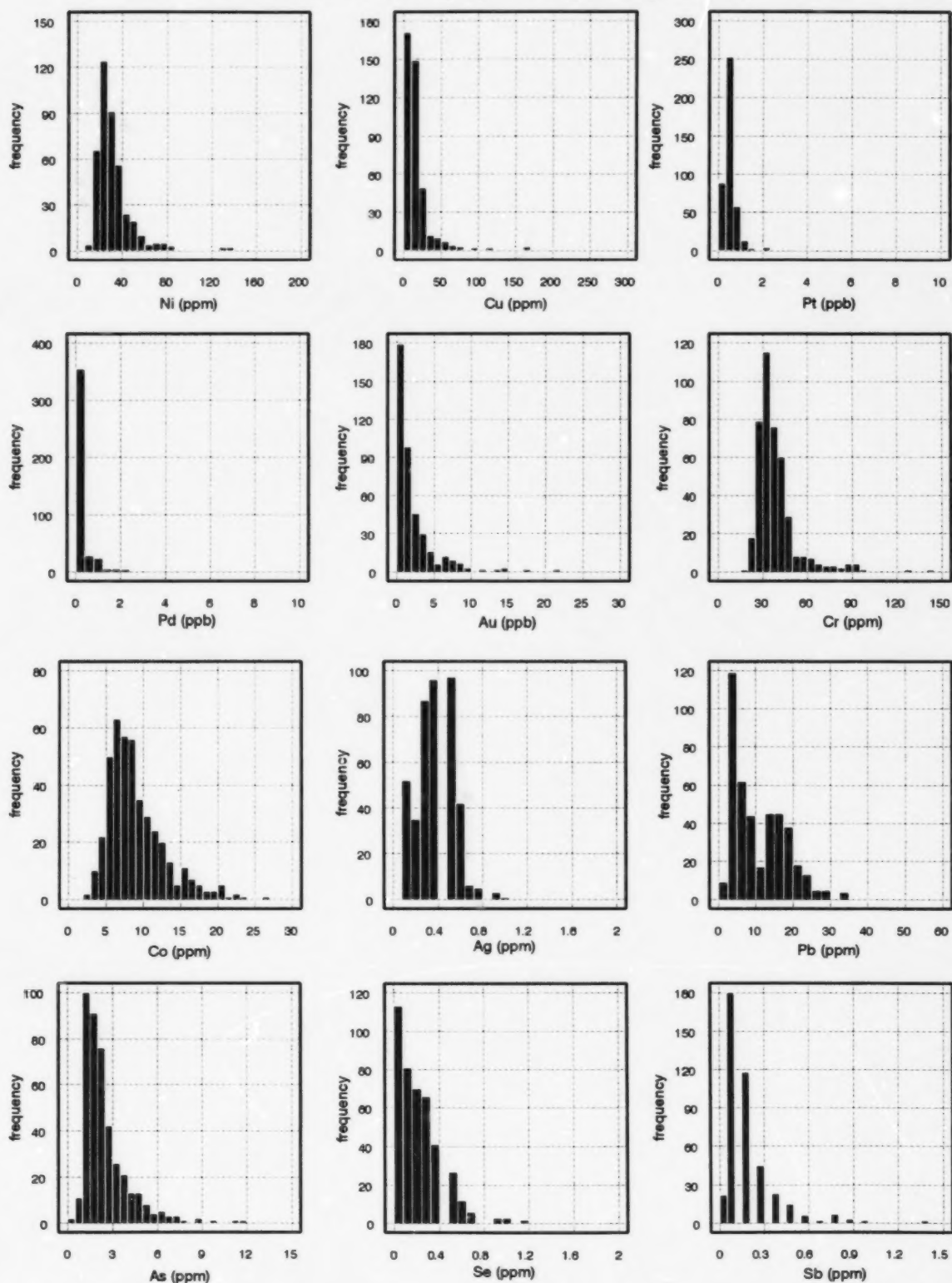


## HUMUS (Sodium Pyrophosphate Digestion)

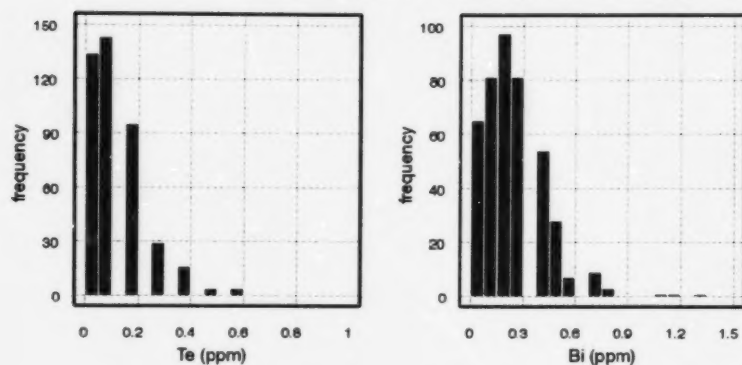




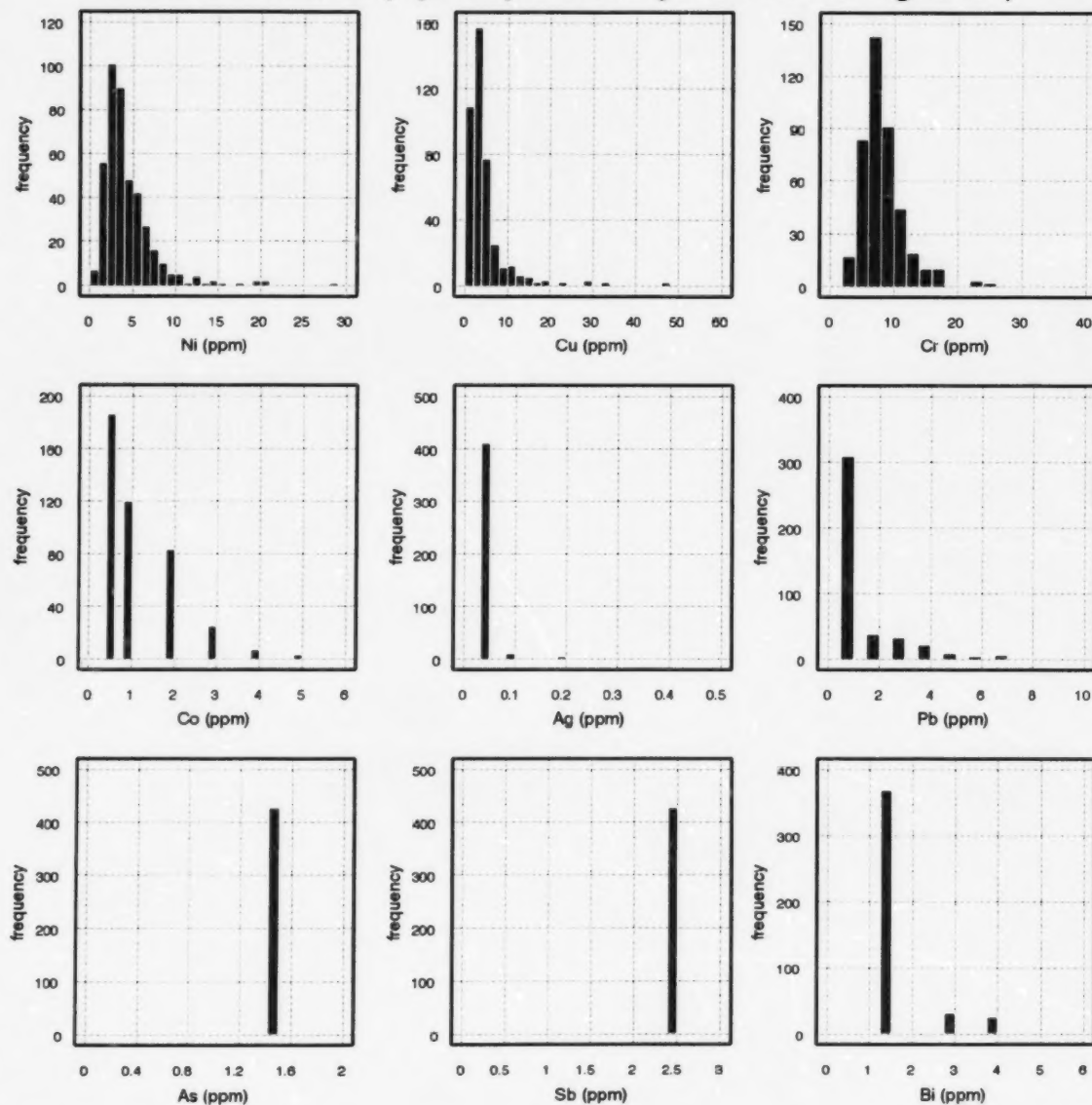
# B-HORIZON TILL (Aqua Regia Digestion)



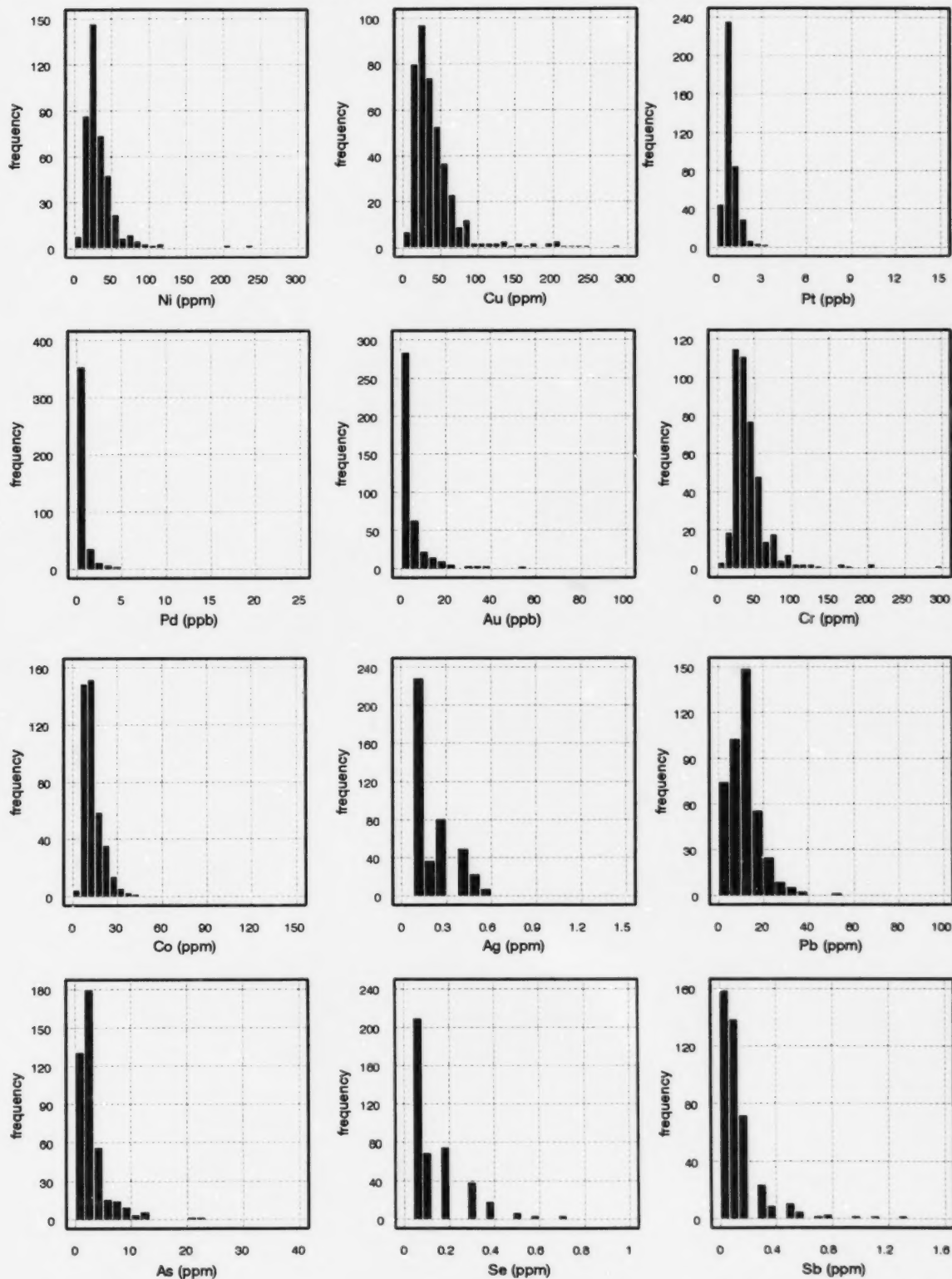
## B-HORIZON TILL (Aqua Regia Digestion)



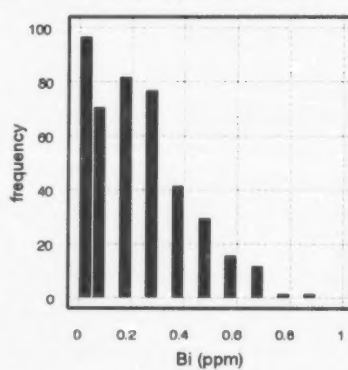
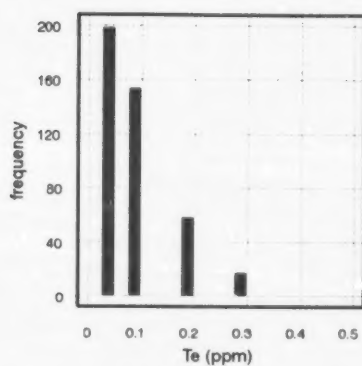
## B-HORIZON TILL (Hydroxylamine Hydrochloride Digestion)



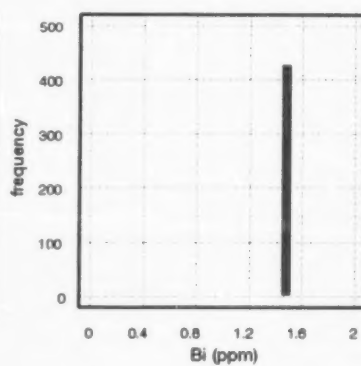
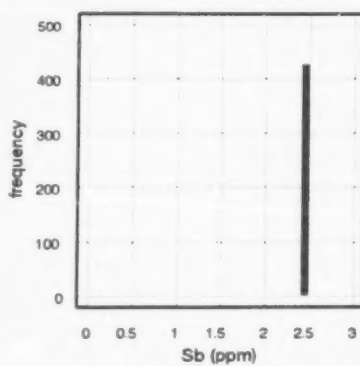
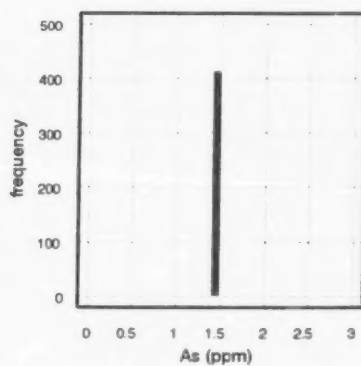
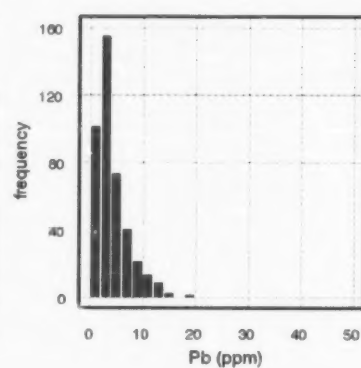
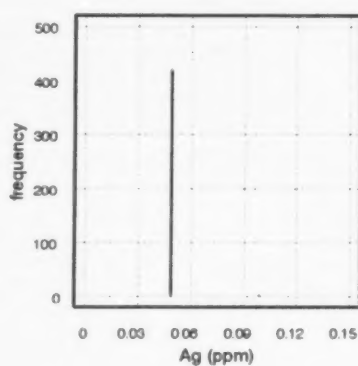
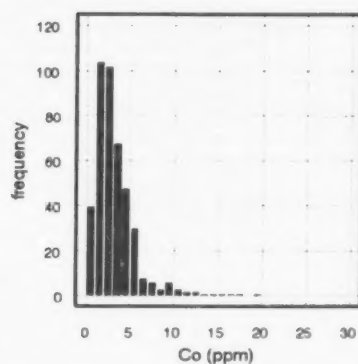
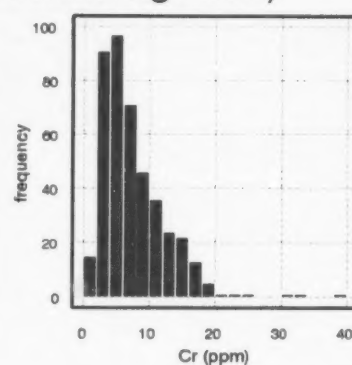
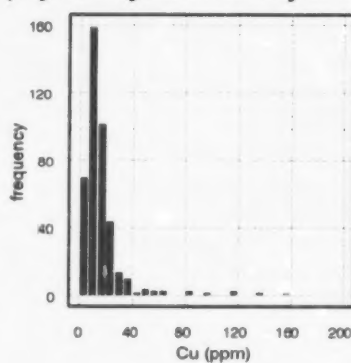
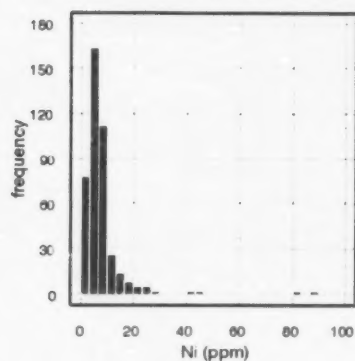
# C-HORIZON TILL (Aqua Regia Digestion)



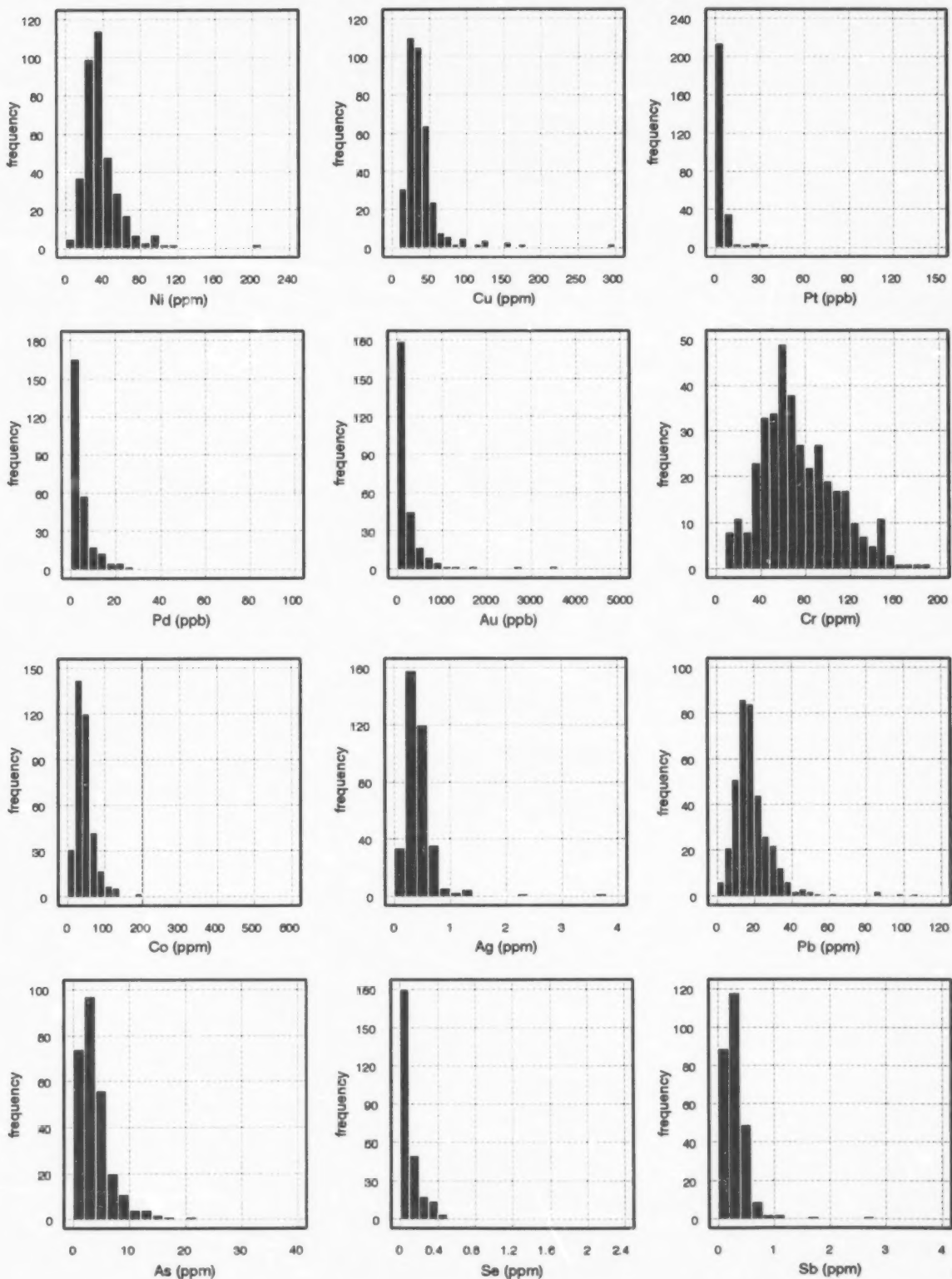
## C-HORIZON TILL (Aqua Regia Digestion)



## C-HORIZON TILL (Hydroxylamine Hydrochloride Digestion)

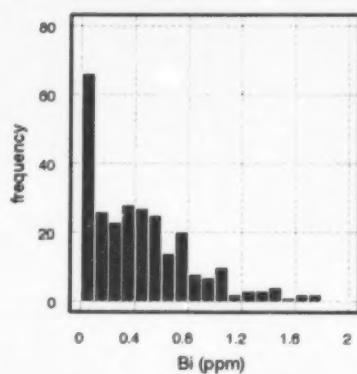
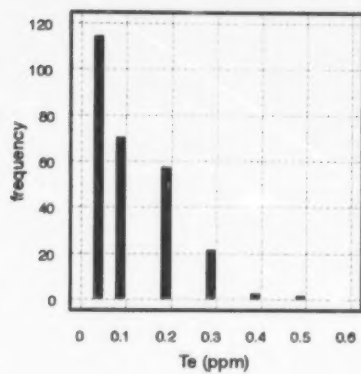


# NON-MAGNETIC HMC OF C-HORIZON TILL (Aqua Regia Digestion)



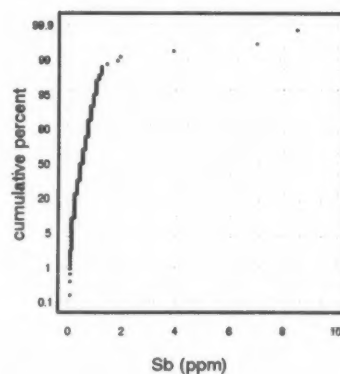
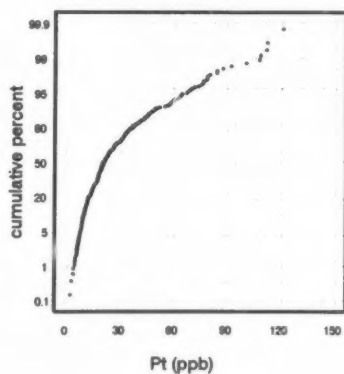
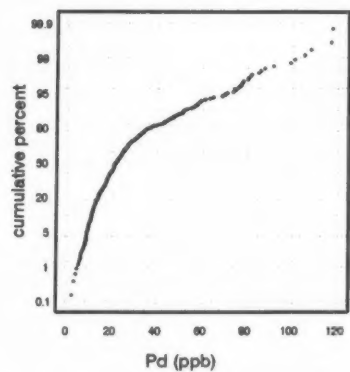
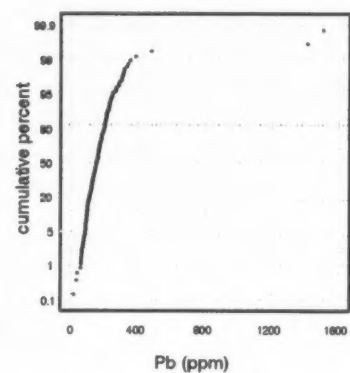
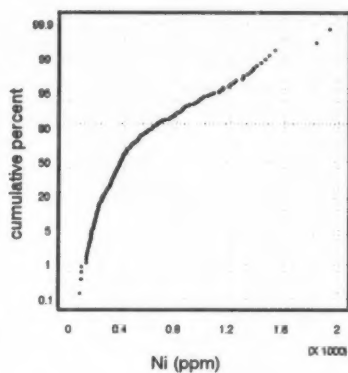
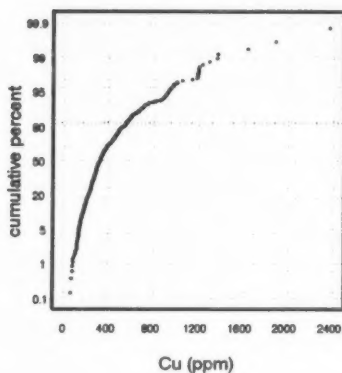
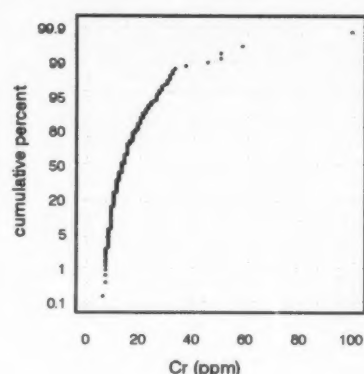
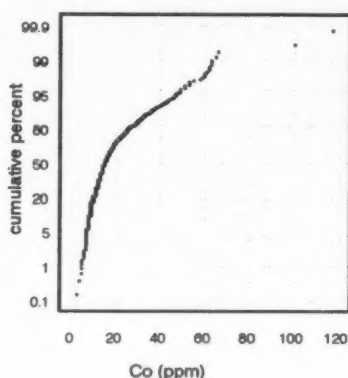
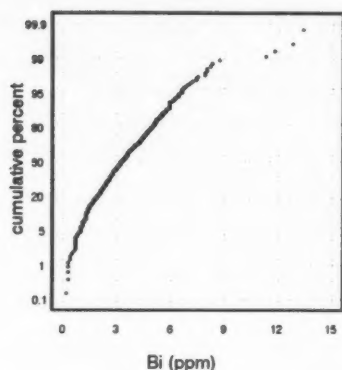
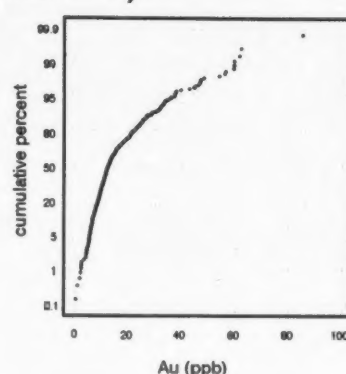
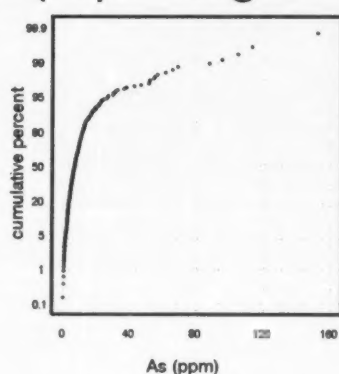
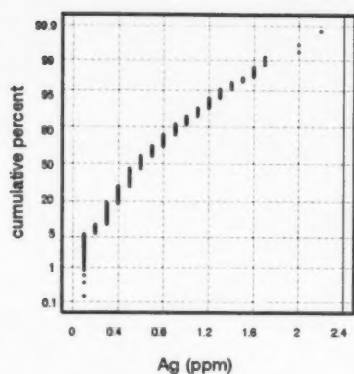


# NON-MAGNETIC HMC OF C-HORIZON TILL (Aqua Regia Digestion)

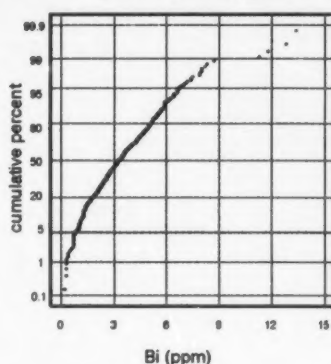
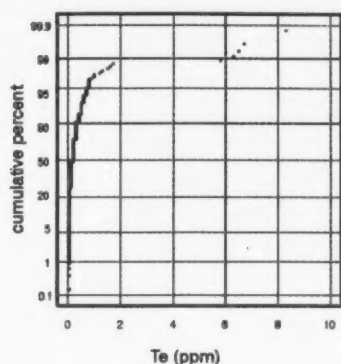


**Appendix M. Cumulative probability plots of geochemistry for the 7 geochemical datasets.**

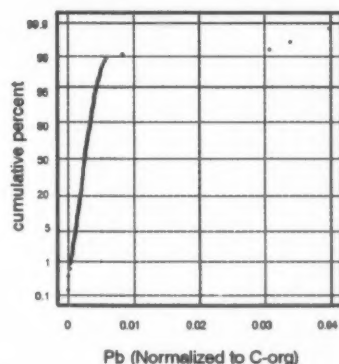
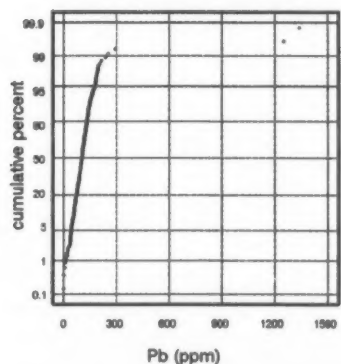
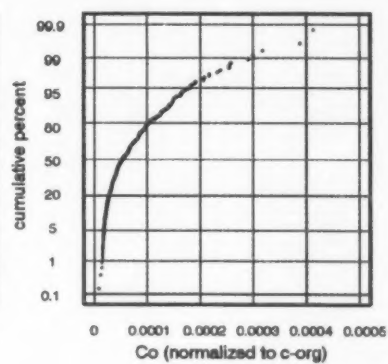
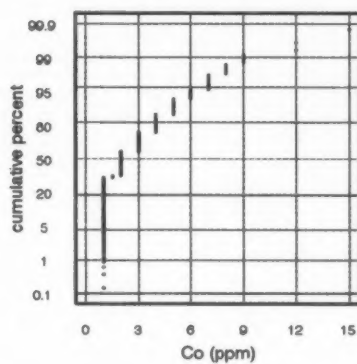
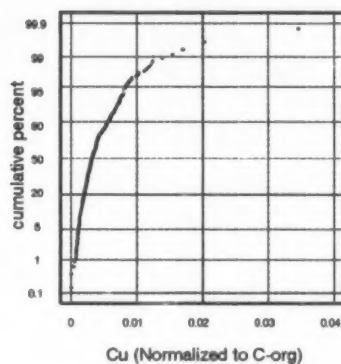
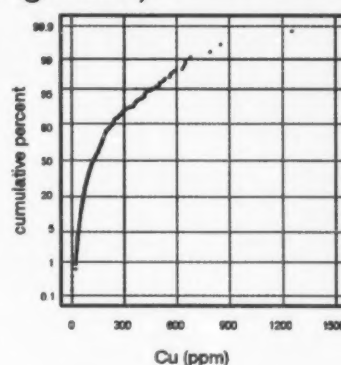
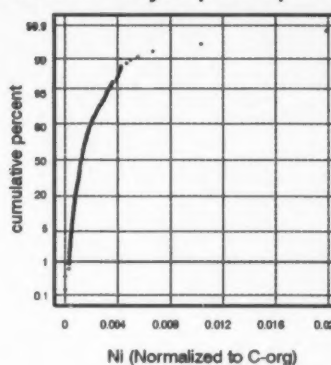
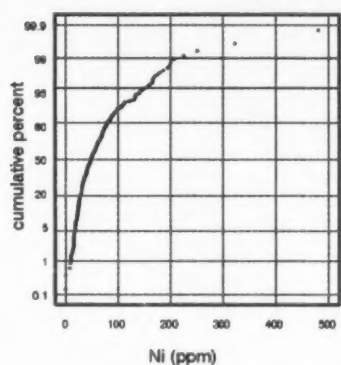
# HUMUS (Aqua Regia Digestion)



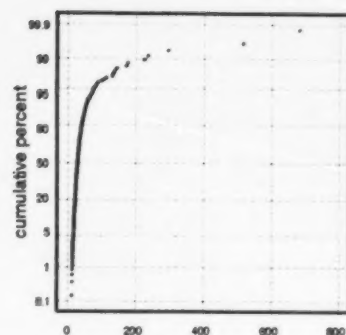
## HUMUS (Aqua Regia Digestion)



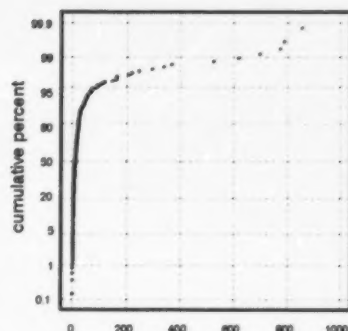
## HUMUS (Sodium Pyrophosphate Digestion)



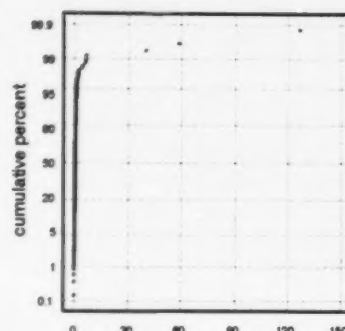
## B-HORIZON TILL (Aqua Regia Digestion)



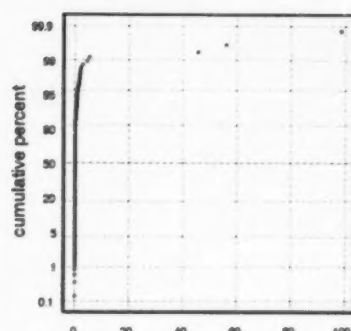
Ni (ppm)



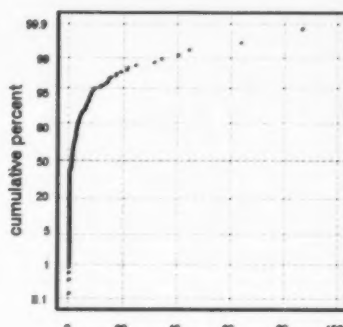
Cu (ppm)



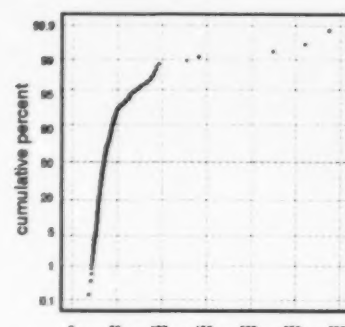
Pt (ppb)



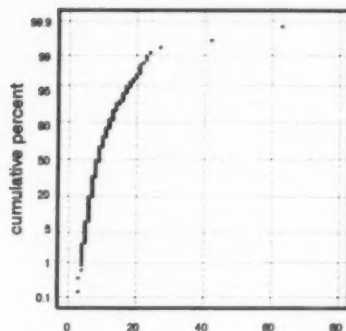
Pd (ppb)



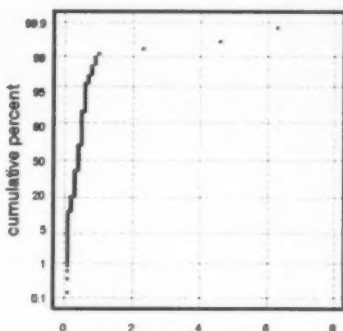
Au (ppb)



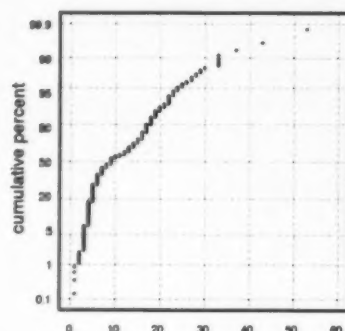
Cr (ppm)



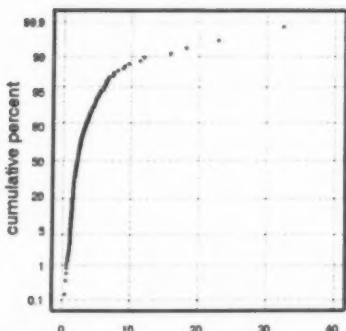
Co (ppm)



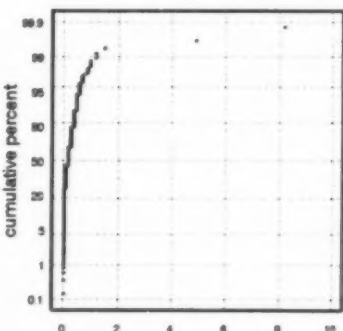
Ag (ppm)



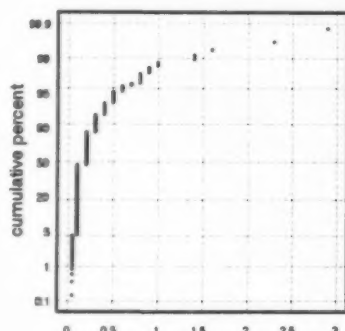
Pb (ppm)



As (ppm)



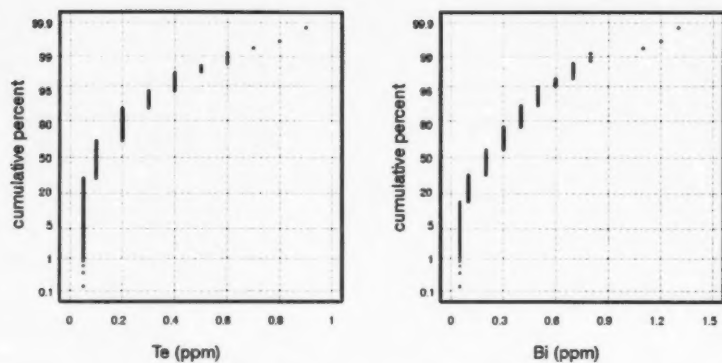
Se (ppm)



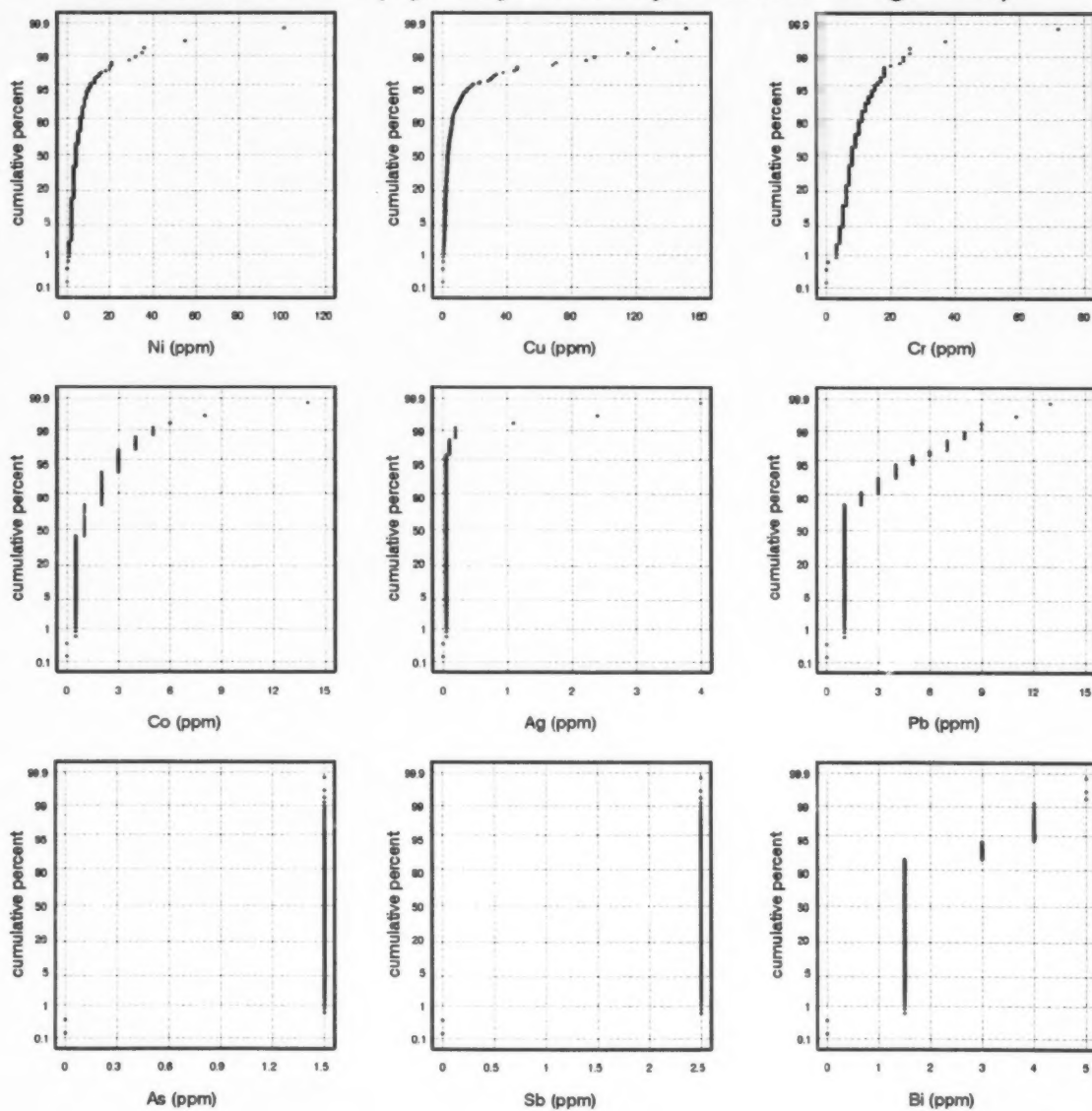
Sb (ppm)



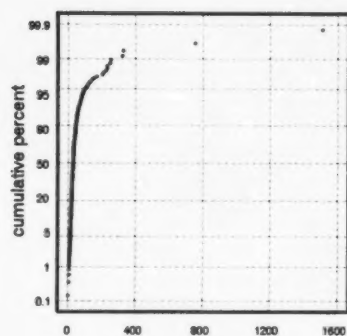
## B-HORIZON TILL (Aqua Regia Digestion)



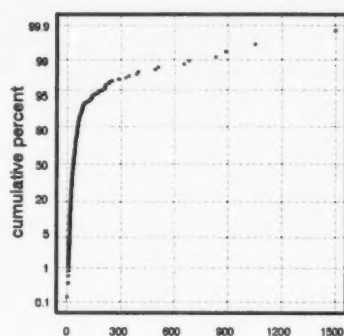
## B-HORIZON TILL (Hydroxylamine Hydrochloride Digestion)



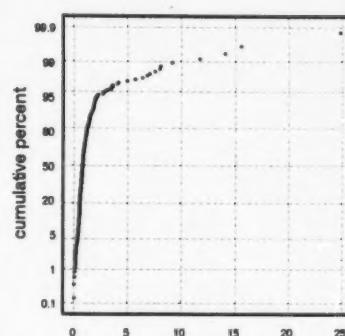
# C-HORIZON TILL (Aqua Regia Digestion)



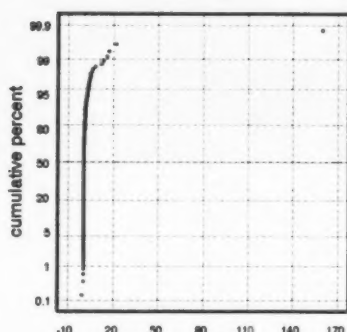
Ni (ppm)



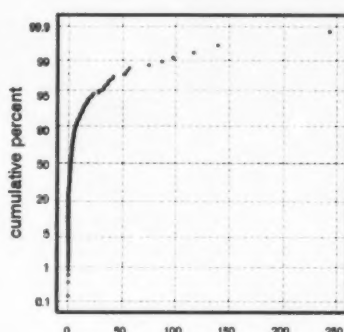
Cu (ppm)



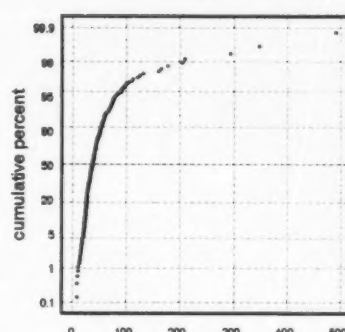
Pt (ppb)



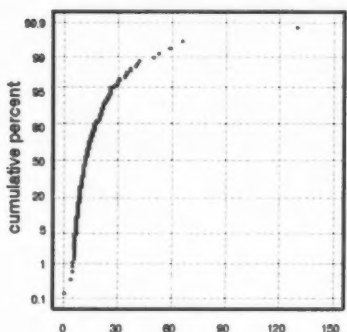
Pd (ppb)



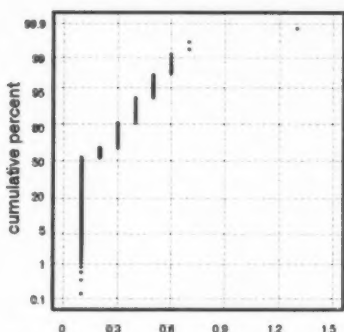
Au (ppb)



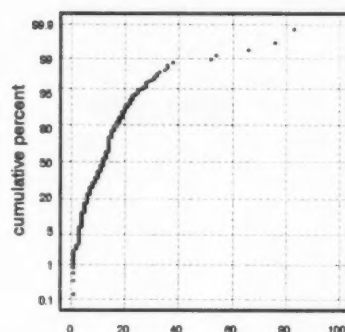
Cr (ppm)



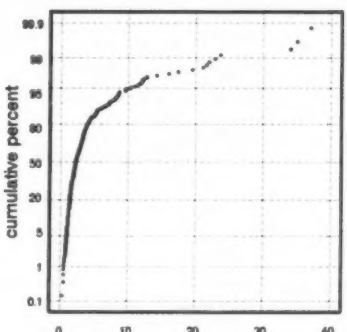
Co (ppm)



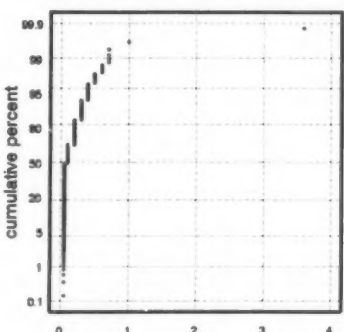
Ag (ppm)



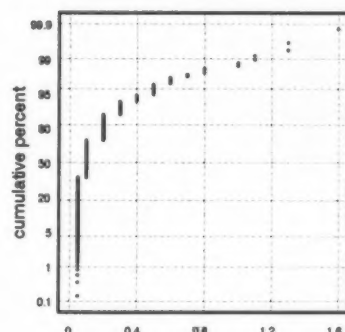
Pb (ppm)



As (ppm)

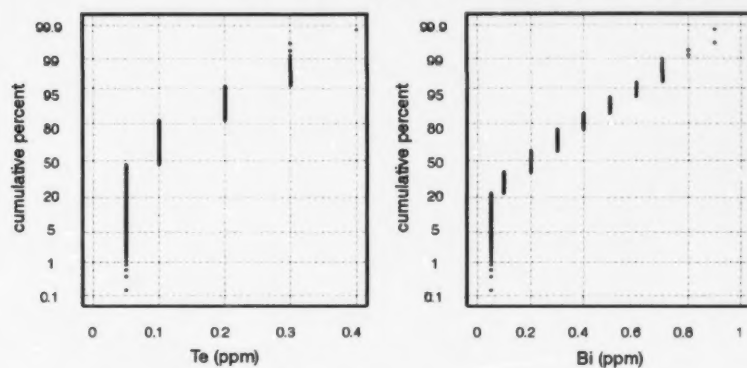


Se (ppm)

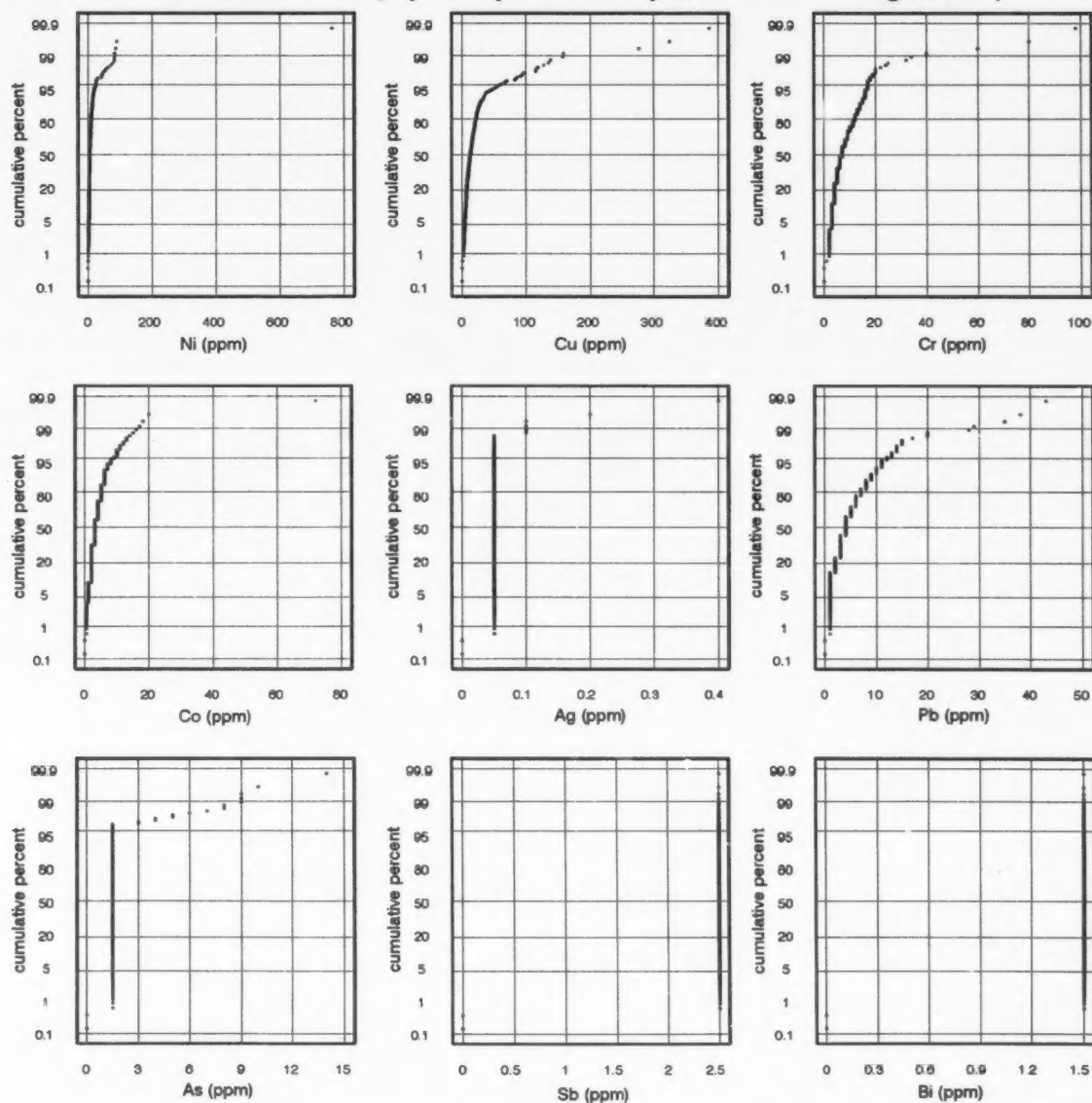


Sb (ppm)

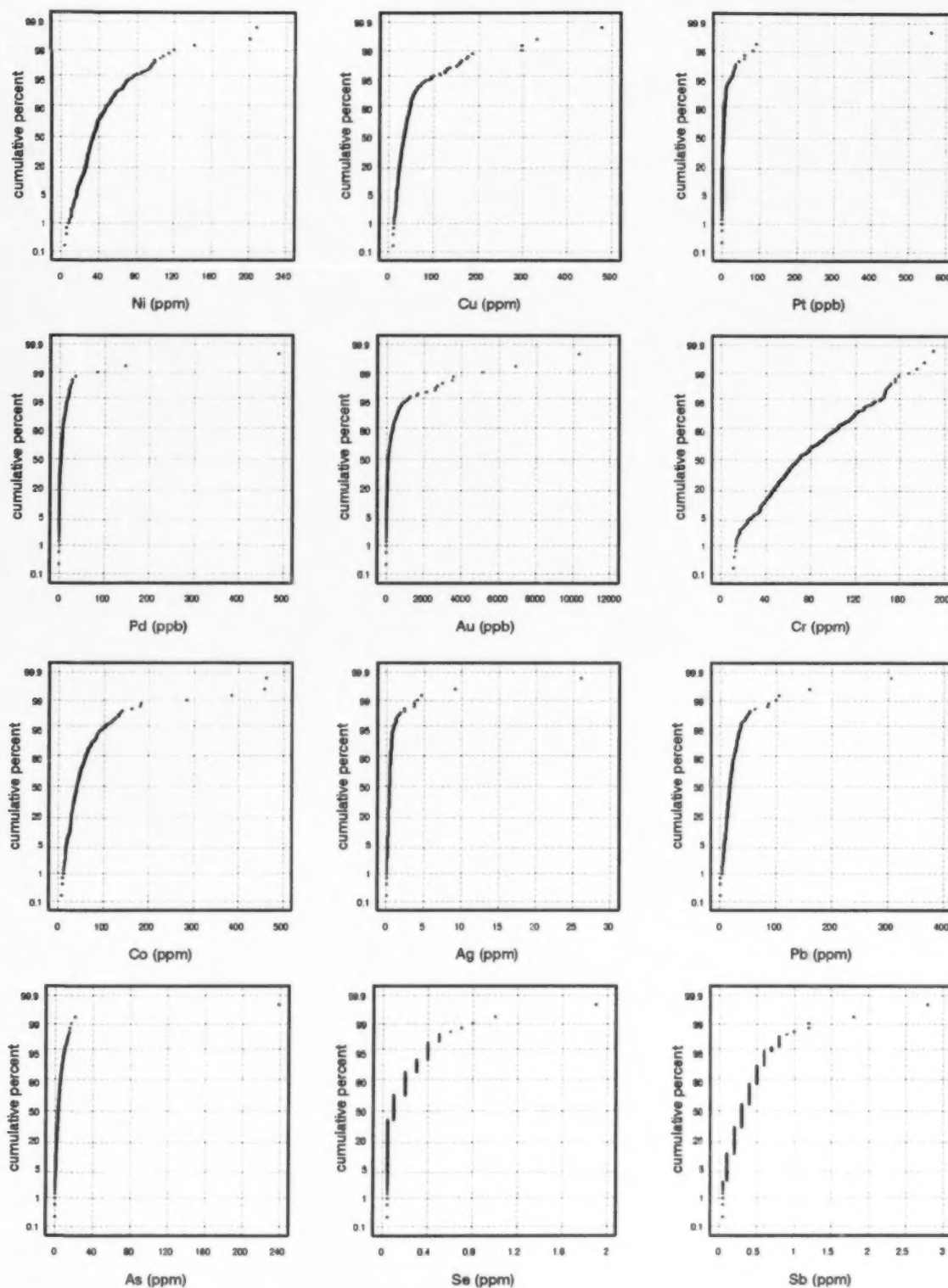
## C-HORIZON TILL (Aqua Regia Digestion)



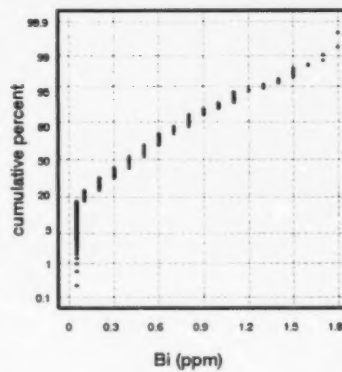
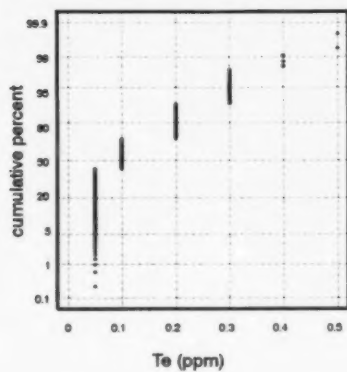
## C-HORIZON TILL (Hydroxylamine Hydrochloride Digestion)



# NON-MAGNETIC HMC OF C-HORIZON TILL (Aqua Regia Digestion)



# NON-MAGNETIC HMC OF C-HORIZON TILL (Aqua Regia Digestion)





**Appendix N. Pearson moment correlation matrices for the 7 geochemical datasets.**

Appendix N. Correlation matrices for humus (aqua regia and sodium pyrophosphate digestions).

HUMUS (Aqua Regia Digestion)

|       | Ni     | Cu     | Pt     | Pd     | Au     | Cr    | Co    | Ag    | Pb    | As    | Se     | Sb     | Te     | Bi     | Mn     | Fe    | C-ORG |
|-------|--------|--------|--------|--------|--------|-------|-------|-------|-------|-------|--------|--------|--------|--------|--------|-------|-------|
| Ni    | 1.000  |        |        |        |        |       |       |       |       |       |        |        |        |        |        |       |       |
| Cu    | 0.874  | 1.000  |        |        |        |       |       |       |       |       |        |        |        |        |        |       |       |
| Pt    | 0.905  | 0.847  | 1.000  |        |        |       |       |       |       |       |        |        |        |        |        |       |       |
| Pd    | 0.929  | 0.891  | 0.955  | 1.000  |        |       |       |       |       |       |        |        |        |        |        |       |       |
| Au    | 0.749  | 0.736  | 0.734  | 0.771  | 1.000  |       |       |       |       |       |        |        |        |        |        |       |       |
| Cr    | 0.388  | 0.434  | 0.401  | 0.394  | 0.293  | 1.000 |       |       |       |       |        |        |        |        |        |       |       |
| Co    | 0.923  | 0.800  | 0.840  | 0.845  | 0.668  | 0.544 | 1.000 |       |       |       |        |        |        |        |        |       |       |
| Ag    | 0.514  | 0.466  | 0.517  | 0.515  | 0.419  | 0.304 | 0.518 | 1.000 |       |       |        |        |        |        |        |       |       |
| Pb    | 0.542  | 0.506  | 0.493  | 0.520  | 0.450  | 0.095 | 0.485 | 0.291 | 1.000 |       |        |        |        |        |        |       |       |
| As    | 0.440  | 0.519  | 0.409  | 0.410  | 0.326  | 0.486 | 0.527 | 0.287 | 0.173 | 1.000 |        |        |        |        |        |       |       |
| Se    | 0.189  | 0.266  | 0.178  | 0.157  | 0.150  | 0.270 | 0.217 | 0.207 | 0.083 | 0.615 | 1.000  |        |        |        |        |       |       |
| Sb    | -0.006 | 0.074  | -0.020 | -0.053 | 0.008  | 0.115 | 0.044 | 0.123 | 0.109 | 0.660 | 0.571  | 1.000  |        |        |        |       |       |
| Te    | 0.425  | 0.433  | 0.393  | 0.411  | 0.333  | 0.273 | 0.421 | 0.187 | 0.255 | 0.439 | 0.304  | 0.092  | 1.000  |        |        |       |       |
| Bi    | 0.377  | 0.410  | 0.343  | 0.333  | 0.313  | 0.238 | 0.400 | 0.309 | 0.277 | 0.728 | 0.586  | 0.706  | 0.262  | 1.000  |        |       |       |
| Mn    | -0.022 | -0.095 | -0.051 | -0.079 | -0.054 | 0.181 | 0.225 | 0.059 | 0.165 | 0.055 | -0.067 | 0.009  | -0.046 | 0.077  | 1.000  |       |       |
| Fe    | 0.738  | 0.719  | 0.721  | 0.731  | 0.583  | 0.711 | 0.783 | 0.521 | 0.285 | 0.593 | 0.368  | 0.187  | 0.344  | 0.457  | 0.039  | 1.000 |       |
| C-ORG | 0.367  | 0.449  | 0.378  | 0.451  | 0.363  | 0.060 | 0.193 | 0.071 | 0.264 | 0.054 | -0.112 | -0.204 | 0.234  | -0.035 | -0.368 | 0.143 | 1.000 |

HUMUS (Sodium Pyrophosphate Digestion)

|       | Ni     | Ni(N)  | Cu     | Cu(N)  | Co     | Co(N)  | Pb     | Pb(N)  | Mn     | Fe    | C-ORG |
|-------|--------|--------|--------|--------|--------|--------|--------|--------|--------|-------|-------|
| Ni    | 1.000  |        |        |        |        |        |        |        |        |       |       |
| Ni(N) | 0.815  | 1.000  |        |        |        |        |        |        |        |       |       |
| Cu    | 0.820  | 0.537  | 1.000  |        |        |        |        |        |        |       |       |
| Cu(N) | 0.729  | 0.764  | 0.857  | 1.000  |        |        |        |        |        |       |       |
| Co    | 0.533  | 0.470  | 0.311  | 0.275  | 1.000  |        |        |        |        |       |       |
| Co(N) | 0.290  | 0.553  | 0.010  | 0.248  | 0.851  | 1.000  |        |        |        |       |       |
| Pb    | 0.153  | -0.070 | 0.413  | 0.263  | 0.105  | -0.098 | 1.000  |        |        |       |       |
| Pb(N) | -0.148 | 0.098  | 0.001  | 0.247  | -0.013 | 0.203  | 0.700  | 1.000  |        |       |       |
| Mn    | -0.132 | 0.046  | -0.225 | -0.085 | 0.091  | 0.241  | -0.059 | 0.169  | 1.000  |       |       |
| Fe    | 0.657  | 0.329  | 0.775  | 0.559  | 0.307  | -0.024 | 0.242  | -0.210 | -0.281 | 1.000 |       |
| C-ORG | 0.389  | -0.217 | 0.528  | 0.015  | -0.390 | 0.369  | -0.406 | -0.295 | 0.584  | 0.143 | 1.000 |

Appendix N. Correlation matrices for B-horizon till (aqua regia and hydroxylamine hydrochloride digestions).

B-HORIZON TILL (Aqua Regia Digestion)

|    | Ni    | Cu    | Pt    | Pd    | Au     | Cr     | Co     | Ag     | Pb     | As    | Se     | Sb    | Te     | Bi    | Mn    | Fe    |
|----|-------|-------|-------|-------|--------|--------|--------|--------|--------|-------|--------|-------|--------|-------|-------|-------|
| Ni | 1.000 |       |       |       |        |        |        |        |        |       |        |       |        |       |       |       |
| Cu | 0.667 | 1.000 |       |       |        |        |        |        |        |       |        |       |        |       |       |       |
| Pt | 0.557 | 0.607 | 1.000 |       |        |        |        |        |        |       |        |       |        |       |       |       |
| Pd | 0.538 | 0.619 | 0.718 | 1.000 |        |        |        |        |        |       |        |       |        |       |       |       |
| Au | 0.218 | 0.275 | 0.333 | 0.298 | 1.000  |        |        |        |        |       |        |       |        |       |       |       |
| Cr | 0.640 | 0.544 | 0.519 | 0.452 | 0.250  | 1.000  |        |        |        |       |        |       |        |       |       |       |
| Co | 0.691 | 0.421 | 0.393 | 0.248 | 0.115  | 0.682  | 1.000  |        |        |       |        |       |        |       |       |       |
| Ag | 0.247 | 0.265 | 0.371 | 0.319 | 0.093  | 0.203  | 0.096  | 1.000  |        |       |        |       |        |       |       |       |
| Pb | 0.157 | 0.225 | 0.075 | 0.168 | 0.036  | 0.356  | 0.325  | -0.055 | 1.000  |       |        |       |        |       |       |       |
| As | 0.294 | 0.300 | 0.283 | 0.172 | 0.126  | 0.235  | 0.208  | 0.102  | 0.135  | 1.000 |        |       |        |       |       |       |
| Se | 0.283 | 0.405 | 0.208 | 0.335 | 0.118  | 0.314  | 0.154  | 0.044  | 0.552  | 0.259 | 1.000  |       |        |       |       |       |
| Sb | 0.011 | 0.048 | 0.090 | 0.046 | 0.045  | 0.037  | 0.010  | 0.080  | 0.085  | 0.478 | 0.247  | 1.000 |        |       |       |       |
| Te | 0.103 | 0.037 | 0.094 | 0.157 | -0.053 | 0.142  | 0.053  | -0.060 | 0.273  | 0.241 | 0.384  | 0.288 | 1.000  |       |       |       |
| Bi | 0.071 | 0.100 | 0.190 | 0.113 | 0.072  | -0.058 | -0.078 | 0.294  | -0.422 | 0.178 | -0.139 | 0.308 | 0.004  | 1.000 |       |       |
| Mn | 0.362 | 0.317 | 0.319 | 0.144 | 0.102  | 0.405  | 0.486  | 0.190  | 0.012  | 0.268 | -0.032 | 0.008 | -0.025 | 0.125 | 1.000 |       |
| Fe | 0.471 | 0.528 | 0.565 | 0.496 | 0.147  | 0.697  | 0.504  | 0.361  | 0.314  | 0.260 | 0.340  | 0.086 | 0.179  | 0.128 | 0.418 | 1.000 |

B-HORIZON TILL (Hydroxylamine Hydrochloride Digestion)

|    | Ni     | Cu     | Cr    | Co     | Ag     | Pb    | As     | Sb    | Bi    | Mn    | Fe    |
|----|--------|--------|-------|--------|--------|-------|--------|-------|-------|-------|-------|
| Ni | 1.000  |        |       |        |        |       |        |       |       |       |       |
| Cu | 0.590  | 1.000  |       |        |        |       |        |       |       |       |       |
| Cr | 0.452  | 0.376  | 1.000 |        |        |       |        |       |       |       |       |
| Co | 0.564  | 0.289  | 0.379 | 1.000  |        |       |        |       |       |       |       |
| Ag | 0.328  | 0.337  | 0.016 | 0.073  | 1.000  |       |        |       |       |       |       |
| Pb | 0.185  | 0.254  | 0.037 | 0.282  | 0.246  | 1.000 |        |       |       |       |       |
| As | 0.000  | 0.000  | 0.000 | 0.000  | 0.000  | 0.000 | 1.000  |       |       |       |       |
| Sb | 0.000  | 0.000  | 0.000 | 0.000  | 0.000  | 0.000 | -1.000 | 1.000 |       |       |       |
| Bi | -0.055 | -0.037 | 0.075 | -0.153 | -0.036 | 0.010 | 0.000  | 0.000 | 1.000 |       |       |
| Mn | 0.357  | 0.244  | 0.362 | 0.429  | 0.074  | 0.239 | 0.000  | 0.000 | 0.057 | 1.000 |       |
| Fe | 0.211  | 0.274  | 0.562 | 0.079  | 0.080  | 0.171 | 0.000  | 0.000 | 0.186 | 0.449 | 1.000 |

Appendix N. Correlation matrices for C-horizon till (aqua regia and hydroxylamine hydrochloride digestions).  
C-HORIZON TILL (Aqua Regia Digestion)

|    | Ni    | Cu    | Pt    | Pd    | Au     | Cr    | Co    | Ag     | Pb     | As    | Se     | Sb    | Te     | Bi    | Mn    | Fe    |
|----|-------|-------|-------|-------|--------|-------|-------|--------|--------|-------|--------|-------|--------|-------|-------|-------|
| Ni | 1.000 |       |       |       |        |       |       |        |        |       |        |       |        |       |       |       |
| Cu | 0.784 | 1.000 |       |       |        |       |       |        |        |       |        |       |        |       |       |       |
| Pt | 0.541 | 0.539 | 1.000 |       |        |       |       |        |        |       |        |       |        |       |       |       |
| Pd | 0.619 | 0.667 | 0.699 | 1.000 |        |       |       |        |        |       |        |       |        |       |       |       |
| Au | 0.214 | 0.177 | 0.336 | 0.319 | 1.000  |       |       |        |        |       |        |       |        |       |       |       |
| Cr | 0.656 | 0.445 | 0.367 | 0.258 | 0.067  | 1.000 |       |        |        |       |        |       |        |       |       |       |
| Co | 0.699 | 0.489 | 0.298 | 0.315 | 0.036  | 0.660 | 1.000 |        |        |       |        |       |        |       |       |       |
| Ag | 0.112 | 0.091 | 0.088 | 0.118 | -0.070 | 0.099 | 0.282 | 1.000  |        |       |        |       |        |       |       |       |
| Pb | 0.196 | 0.139 | 0.079 | 0.040 | -0.080 | 0.352 | 0.368 | 0.037  | 1.000  |       |        |       |        |       |       |       |
| As | 0.291 | 0.189 | 0.299 | 0.281 | 0.316  | 0.195 | 0.378 | 0.037  | 0.242  | 1.000 |        |       |        |       |       |       |
| Se | 0.284 | 0.216 | 0.198 | 0.187 | 0.051  | 0.430 | 0.246 | -0.034 | 0.532  | 0.283 | 1.000  |       |        |       |       |       |
| Sb | 0.046 | 0.049 | 0.116 | 0.109 | 0.049  | 0.099 | 0.118 | 0.000  | 0.277  | 0.386 | 0.294  | 1.000 |        |       |       |       |
| Te | 0.100 | 0.053 | 0.111 | 0.030 | 0.037  | 0.309 | 0.123 | -0.069 | 0.282  | 0.155 | 0.377  | 0.332 | 1.000  |       |       |       |
| Bi | 0.020 | 0.039 | 0.027 | 0.034 | 0.033  | 0.015 | 0.027 | -0.033 | -0.096 | 0.144 | -0.017 | 0.172 | 0.077  | 1.000 |       |       |
| Mn | 0.352 | 0.322 | 0.124 | 0.213 | -0.039 | 0.267 | 0.678 | 0.326  | 0.191  | 0.318 | -0.046 | 0.170 | -0.005 | 0.110 | 1.000 |       |
| Fe | 0.474 | 0.376 | 0.232 | 0.283 | -0.078 | 0.627 | 0.777 | 0.417  | 0.423  | 0.257 | 0.391  | 0.218 | 0.201  | 0.024 | 0.657 | 1.000 |

C-HORIZON TILL (Hydroxylamine Hydrochloride Digestion)

|    | Ni    | Cu    | Cr     | Co    | Ag     | Pb    | As    | Sb     | Bi    | Mn    | Fe    |
|----|-------|-------|--------|-------|--------|-------|-------|--------|-------|-------|-------|
| Ni | 1.000 |       |        |       |        |       |       |        |       |       |       |
| Cu | 0.748 | 1.000 |        |       |        |       |       |        |       |       |       |
| Cr | 0.439 | 0.220 | 1.000  |       |        |       |       |        |       |       |       |
| Co | 0.619 | 0.430 | 0.281  | 1.000 |        |       |       |        |       |       |       |
| Ag | 0.137 | 0.240 | 0.099  | 0.006 | 1.000  |       |       |        |       |       |       |
| Pb | 0.213 | 0.200 | 0.113  | 0.461 | 0.088  | 1.000 |       |        |       |       |       |
| As | 0.254 | 0.212 | 0.008  | 0.226 | -0.019 | 0.195 | 1.000 |        |       |       |       |
| Sb | 0.000 | 0.000 | 0.000  | 0.000 | 0.000  | 0.000 | 0.000 | 1.000  |       |       |       |
| Bi | 0.000 | 0.000 | 0.000  | 0.000 | 0.000  | 0.000 | 0.000 | -1.000 | 1.000 |       |       |
| Mn | 0.313 | 0.342 | -0.021 | 0.687 | 0.010  | 0.364 | 0.151 | 0.000  | 0.000 | 1.000 |       |
| Fe | 0.417 | 0.271 | 0.693  | 0.433 | 0.233  | 0.411 | 0.047 | 0.000  | 0.000 | 0.196 | 1.000 |

Appendix N. Correlation matrices for the non-magnetic HMC fraction of C-horizon till (aqua regia digestion).

|    | Ni     | Cu    | Pt     | Pd     | Au     | Cr     | Co     | Ag     | Pb     | As    | Se     | Sb     | Te     | Bi     | Mn    | Fe    |
|----|--------|-------|--------|--------|--------|--------|--------|--------|--------|-------|--------|--------|--------|--------|-------|-------|
| Ni | 1.000  |       |        |        |        |        |        |        |        |       |        |        |        |        |       |       |
| Cu | 0.490  | 1.000 |        |        |        |        |        |        |        |       |        |        |        |        |       |       |
| Pt | 0.147  | 0.155 | 1.000  |        |        |        |        |        |        |       |        |        |        |        |       |       |
| Pd | 0.144  | 0.234 | 0.616  | 1.000  |        |        |        |        |        |       |        |        |        |        |       |       |
| Au | 0.150  | 0.052 | 0.040  | 0.100  | 1.000  |        |        |        |        |       |        |        |        |        |       |       |
| Cr | 0.267  | 0.214 | -0.001 | 0.054  | 0.372  | 1.000  |        |        |        |       |        |        |        |        |       |       |
| Co | 0.721  | 0.351 | 0.115  | 0.140  | 0.040  | 0.105  | 1.000  |        |        |       |        |        |        |        |       |       |
| Ag | 0.068  | 0.143 | 0.017  | 0.057  | 0.051  | 0.008  | 0.242  | 1.000  |        |       |        |        |        |        |       |       |
| Pb | -0.275 | 0.080 | 0.030  | 0.056  | -0.039 | -0.116 | -0.068 | 0.263  | 1.000  |       |        |        |        |        |       |       |
| As | 0.372  | 0.211 | 0.084  | 0.209  | 0.233  | 0.226  | 0.516  | 0.157  | -0.036 | 1.000 |        |        |        |        |       |       |
| Se | 0.101  | 0.244 | 0.038  | 0.031  | -0.058 | -0.052 | 0.262  | 0.181  | 0.212  | 0.278 | 1.000  |        |        |        |       |       |
| Sb | 0.104  | 0.086 | 0.065  | 0.142  | 0.258  | 0.370  | 0.165  | 0.045  | 0.039  | 0.649 | 0.139  | 1.000  |        |        |       |       |
| Te | 0.151  | 0.035 | 0.077  | -0.077 | -0.011 | -0.073 | 0.151  | 0.023  | 0.000  | 0.237 | 0.300  | 0.248  | 1.000  |        |       |       |
| Bi | 0.106  | 0.058 | 0.033  | 0.013  | 0.122  | 0.265  | 0.118  | -0.060 | 0.020  | 0.252 | 0.013  | 0.330  | 0.127  | 1.000  |       |       |
| Mn | 0.252  | 0.228 | -0.078 | -0.023 | 0.011  | 0.010  | 0.011  | 0.115  | -0.110 | 0.029 | 0.026  | -0.186 | -0.040 | -0.030 | 1.000 |       |
| Fe | 0.472  | 0.121 | -0.064 | 0.045  | 0.194  | 0.407  | 0.470  | 0.120  | -0.382 | 0.408 | -0.068 | 0.451  | 0.124  | 0.188  | 0.231 | 1.000 |



Appendix N. Correlation matrices between media for Sudbury ore and pathfinder elements.

|        | Ni (1) | Ni (2) | Ni (3) | Ni (4) | Ni (5) | Ni (6) | Ni (7) |
|--------|--------|--------|--------|--------|--------|--------|--------|
| Ni (1) | 1.000  |        |        |        |        |        |        |
| Ni (2) | 0.668  | 1.000  |        |        |        |        |        |
| Ni (3) | 0.476  | 0.815  | 1.000  |        |        |        |        |
| Ni (4) | 0.256  | 0.375  | 0.313  | 1.000  |        |        |        |
| Ni (5) | 0.321  | 0.417  | 0.356  | 0.846  | 1.000  |        |        |
| Ni (6) | 0.120  | 0.261  | 0.224  | 0.613  | 0.511  | 1.000  |        |
| Ni (7) | 0.180  | 0.290  | 0.234  | 0.530  | 0.504  | 0.831  | 1.000  |
| Ni (7) | 0.192  | 0.297  | 0.234  | 0.494  | 0.482  | 0.563  | 0.501  |

|        | Cu (1) | Cu (2) | Cu (3) | Cu (4) | Cu (5) | Cu (6) | Cu (7) |
|--------|--------|--------|--------|--------|--------|--------|--------|
| Cu (1) | 1.000  |        |        |        |        |        |        |
| Cu (2) | 0.933  | 1.000  |        |        |        |        |        |
| Cu (3) | 0.826  | 0.857  | 1.000  |        |        |        |        |
| Cu (4) | 0.182  | 0.155  | 0.080  | 1.000  |        |        |        |
| Cu (5) | 0.215  | 0.188  | 0.120  | 0.945  | 1.000  |        |        |
| Cu (6) | 0.026  | 0.020  | 0.003  | 0.603  | 0.537  | 1.000  |        |
| Cu (7) | 0.029  | 0.018  | -0.018 | 0.494  | 0.472  | 0.872  | 1.000  |
| Cu (7) | 0.042  | 0.012  | 0.028  | 0.532  | 0.461  | 0.690  | 0.607  |

|        | Co (1) | Co (2) | Co (3) | Co (4) | Co (5) | Co (6) | Co (7) |
|--------|--------|--------|--------|--------|--------|--------|--------|
| Co (1) | 1.000  |        |        |        |        |        |        |
| Co (2) | 0.401  | 1.000  |        |        |        |        |        |
| Co (3) | 0.271  | 0.851  | 1.000  |        |        |        |        |
| Co (4) | 0.203  | 0.079  | 0.004  | 1.000  |        |        |        |
| Co (5) | 0.180  | 0.061  | -0.019 | 0.764  | 1.000  |        |        |
| Co (6) | 0.103  | -0.035 | -0.040 | 0.368  | 0.235  | 1.000  |        |
| Co (7) | 0.134  | 0.037  | 0.018  | 0.182  | 0.169  | 0.723  | 1.000  |
| Co (7) | 0.111  | -0.064 | -0.092 | 0.292  | 0.228  | 0.470  | 0.230  |

|        | Pb (1) | Pb (2) | Pb (3) | Pb (4) | Pb (5) | Pb (6) | Pb (7) |
|--------|--------|--------|--------|--------|--------|--------|--------|
| Pb (1) | 1.000  |        |        |        |        |        |        |
| Pb (2) | 0.776  | 1.000  |        |        |        |        |        |
| Pb (3) | 0.559  | 0.700  | 1.000  |        |        |        |        |
| Pb (4) | 0.323  | 0.260  | -0.053 | 1.000  |        |        |        |
| Pb (5) | 0.032  | 0.032  | -0.005 | 0.375  | 1.000  |        |        |
| Pb (6) | 0.223  | 0.121  | -0.095 | 0.609  | 0.285  | 1.000  |        |
| Pb (7) | -0.070 | -0.110 | -0.055 | 0.071  | 0.380  | 0.515  | 1.000  |
| Pb (7) | 0.011  | -0.009 | 0.134  | 0.070  | 0.270  | 0.220  | 0.360  |

|        | Mn (1) | Mn (2) | Mn (3) | Mn (4) | Mn (5) | Mn (6) | Mn (7) |
|--------|--------|--------|--------|--------|--------|--------|--------|
| Mn (1) | 1.000  |        |        |        |        |        |        |
| Mn (2) | 0.913  | 1.000  |        |        |        |        |        |
| Mn (3) | 0.266  | 0.286  | 1.000  |        |        |        |        |
| Mn (4) | 0.253  | 0.249  | 0.753  | 1.000  |        |        |        |
| Mn (5) | 0.182  | 0.113  | 0.233  | 0.202  | 1.000  |        |        |
| Mn (6) | 0.213  | 0.149  | 0.213  | 0.299  | 0.743  | 1.000  |        |
| Mn (7) | 0.112  | 0.074  | -0.027 | -0.022 | -0.055 | 0.069  | 1.000  |

|        | Fe (1) | Fe (2) | Fe (3) | Fe (4) | Fe (5) | Fe (6) | Fe (7) |
|--------|--------|--------|--------|--------|--------|--------|--------|
| Fe (1) | 1.000  |        |        |        |        |        |        |
| Fe (2) | 0.646  | 1.000  |        |        |        |        |        |
| Fe (3) | 0.047  | 0.048  | 1.000  |        |        |        |        |
| Fe (4) | -0.017 | 0.004  | 0.448  | 1.000  |        |        |        |
| Fe (5) | 0.009  | -0.174 | 0.184  | 0.028  | 1.000  |        |        |
| Fe (6) | 0.015  | -0.104 | 0.164  | 0.009  | 0.814  | 1.000  |        |
| Fe (7) | 0.109  | 0.120  | 0.071  | 0.007  | -0.118 | -0.057 | 1.000  |

Appendix N. Correlation matrices between media for Sudbury ore and pathfinder elements (cont'd.).

| Cr (1) |        |        |        |        |        |        | Ag (1) |        |        |        |        |        |        | As (1) |        |        |        |        |        |        |
|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| Cr (1) | Cr (2) | Cr (3) | Cr (4) | Cr (5) | Cr (6) | Cr (7) | Ag (1) | Ag (2) | Ag (3) | Ag (4) | Ag (5) | Ag (6) | Ag (7) | As (1) | As (2) | As (3) | As (4) | As (5) | As (6) | As (7) |
| 1.000  | 0.115  | 1.000  |        |        |        |        | 1.000  |        |        |        |        |        |        | 1.000  |        |        |        |        |        |        |
| 0.115  | 1.000  |        |        |        |        |        | 0.069  |        | 1.000  |        |        |        |        | 0.290  |        | 1.000  |        |        |        |        |
| 0.100  | 0.690  | 1.000  |        |        |        |        | 0.094  |        | 0.399  | 1.000  |        |        |        | 0.000  |        | 0.000  | 1.000  |        |        |        |
| 0.080  | 0.549  | 0.372  | 1.000  |        |        |        | 0.002  |        | 0.172  | -0.015 | 1.000  |        |        | 0.311  |        | 0.531  | 0.000  | 1.000  |        |        |
| 0.032  | 0.466  | 0.353  | 0.866  | 1.000  |        |        | 0.008  |        | 0.032  | -0.012 | 0.079  | 1.000  |        | 0.140  |        | 0.270  | 0.000  | 0.455  | 1.000  |        |
| 0.144  | 0.229  | 0.224  | 0.301  | 0.209  | 1.000  |        | -0.067 |        | -0.003 | -0.044 | 0.215  | -0.004 | 1.000  | 0.176  |        | 0.310  | 0.000  | 0.525  | 0.169  | 1.000  |

| Sb (1) |        |        |        |        |        |        | Bi (1) |        |        |        |        |        |        | Te (1) |        |        |        |        |        |        |
|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| Sb (1) | Sb (2) | Sb (3) | Sb (4) | Sb (5) | Sb (6) | Sb (7) | Bi (1) | Bi (2) | Bi (3) | Bi (4) | Bi (5) | Bi (6) | Bi (7) | Te (1) | Te (2) | Te (3) | Te (4) | Te (5) | Te (6) | Te (7) |
| 1.000  |        |        |        |        |        |        | 1.000  |        |        |        |        |        |        | 1.000  |        |        |        |        |        |        |
| -0.016 | 1.000  |        |        |        |        |        | 0.328  |        | 1.000  |        |        |        |        | 0.026  |        | 1.000  |        |        |        |        |
| 0.000  | 0.000  | 1.000  |        |        |        |        | 0.181  |        | 0.276  | 1.000  |        |        |        | -0.039 |        | 0.244  |        | 1.000  |        |        |
| -0.159 | 0.037  | 0.000  | 1.000  |        |        |        | 0.098  |        | -0.030 | -0.034 | 1.000  |        |        | 0.128  |        | 0.198  |        | 0.074  |        | 1.000  |
| 0.000  | 0.000  | 1.000  | 0.000  | 1.000  |        |        | 0.000  |        | 0.000  | 0.000  | 0.000  | 1.000  |        |        |        |        |        |        |        |        |
| 0.184  | 0.033  | 0.000  | 0.020  | 0.000  | 1.000  |        | 0.119  |        | 0.076  | -0.013 | 0.112  | 0.000  | 1.000  |        |        |        |        |        |        |        |

| Pt (1) |        |        |        |        |        |        | Pd (1) |        |        |        |        |        |        | Au (1) |        |        |        |        |        |        |
|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| Pt (1) | Pt (2) | Pt (3) | Pt (4) | Pt (5) | Pt (6) | Pt (7) | Pd (1) | Pd (2) | Pd (3) | Pd (4) | Pd (5) | Pd (6) | Pd (7) | Au (1) | Au (2) | Au (3) | Au (4) | Au (5) | Au (6) | Au (7) |
| 1.000  |        |        |        |        |        |        | 1.000  |        |        |        |        |        |        | 1.000  |        |        |        |        |        |        |
| 0.243  | 1.000  |        |        |        |        |        | 0.141  |        | 1.000  |        |        |        |        | 0.109  |        | 1.000  |        |        |        |        |
| 0.144  | 0.310  | 1.000  |        |        |        |        | 0.040  |        | 0.413  | 1.000  |        |        |        | 0.126  |        | 0.177  |        | 1.000  |        |        |
| 0.112  | 0.280  | 0.296  | 1.000  |        |        |        | -0.090 |        | 0.119  | 0.154  | 1.000  |        |        | 0.046  |        | 0.085  |        | 0.266  |        | 1.000  |

| Se (1) |        |        |        |        |        |        | Te (1) |        |        |        |        |        |        | Au (1) |        |        |        |        |        |        |
|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| Se (1) | Se (2) | Se (3) | Se (4) | Se (5) | Se (6) | Se (7) | Te (1) | Te (2) | Te (3) | Te (4) | Te (5) | Te (6) | Te (7) | Au (1) | Au (2) | Au (3) | Au (4) | Au (5) | Au (6) | Au (7) |
| 1.000  |        |        |        |        |        |        | 1.000  |        |        |        |        |        |        | 1.000  |        |        |        |        |        |        |
|        | 1.000  |        |        |        |        |        | 0.026  |        | 1.000  |        |        |        |        | 0.109  |        | 1.000  |        |        |        |        |
|        |        | 1.000  |        |        |        |        | -0.039 |        | 0.244  |        |        |        |        | 0.126  |        | 0.177  |        | 1.000  |        |        |
|        |        |        | 1.000  |        |        |        | 0.128  |        | 0.198  |        |        |        |        | 0.046  |        | 0.085  |        | 0.266  |        | 1.000  |
|        |        |        |        | 1.000  |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |
|        |        |        |        |        | 1.000  |        |        |        |        |        |        |        |        |        |        |        |        |        |        |        |
|        |        |        |        |        |        | 1.000  |        |        |        |        |        |        |        |        |        |        |        |        |        |        |

# Metric Conversion Table

| Conversion from SI to Imperial |                      |                              | Conversion from Imperial to SI |                       |                 |
|--------------------------------|----------------------|------------------------------|--------------------------------|-----------------------|-----------------|
| <i>SI Unit</i>                 | <i>Multiplied by</i> | <i>Gives</i>                 | <i>Imperial Unit</i>           | <i>Multiplied by</i>  | <i>Gives</i>    |
| LENGTH                         |                      |                              |                                |                       |                 |
| 1 mm                           | 0.039 37             | inches                       | 1 inch                         | <b>25.4</b>           | mm              |
| 1 cm                           | 0.393 70             | inches                       | 1 inch                         | <b>2.54</b>           | cm              |
| 1 m                            | 3.280 84             | feet                         | 1 foot                         | <b>0.304 8</b>        | m               |
| 1 m                            | 0.049 709            | chains                       | 1 chain                        | 20.116 8              | m               |
| 1 km                           | 0.621 371            | miles (statute)              | 1 mile (statute)               | <b>1.609 344</b>      | km              |
| AREA                           |                      |                              |                                |                       |                 |
| 1 cm <sup>2</sup>              | 0.155 0              | square inches                | 1 square inch                  | <b>6.451 6</b>        | cm <sup>2</sup> |
| 1 m <sup>2</sup>               | 10.763 9             | square feet                  | 1 square foot                  | <b>0.092 903 04</b>   | m <sup>2</sup>  |
| 1 km <sup>2</sup>              | 0.386 10             | square miles                 | 1 square mile                  | 2.589 988             | km <sup>2</sup> |
| 1 ha                           | 2.471 054            | acres                        | 1 acre                         | 0.404 685 6           | ha              |
| VOLUME                         |                      |                              |                                |                       |                 |
| 1 cm <sup>3</sup>              | 0.061 023            | cubic inches                 | 1 cubic inch                   | <b>16.387 064</b>     | cm <sup>3</sup> |
| 1 m <sup>3</sup>               | 35.314 7             | cubic feet                   | 1 cubic foot                   | 0.028 316 85          | m <sup>3</sup>  |
| 1 m <sup>3</sup>               | 1.307 951            | cubic yards                  | 1 cubic yard                   | 0.764 554 86          | m <sup>3</sup>  |
| CAPACITY                       |                      |                              |                                |                       |                 |
| 1 L                            | 1.759 755            | pints                        | 1 pint                         | 0.568 261             | L               |
| 1 L                            | 0.879 877            | quarts                       | 1 quart                        | 1.136 522             | L               |
| 1 L                            | 0.219 969            | gallons                      | 1 gallon                       | <b>4.546 090</b>      | L               |
| MASS                           |                      |                              |                                |                       |                 |
| 1 g                            | 0.035 273 962        | ounces (avdp)                | 1 ounce (avdp)                 | 28.349 523            | g               |
| 1 g                            | 0.032 150 747        | ounces (troy)                | 1 ounce (troy)                 | <b>31.103 476 8</b>   | g               |
| 1 kg                           | 2.204 622 6          | pounds (avdp)                | 1 pound (avdp)                 | <b>0.453 592 37</b>   | kg              |
| 1 kg                           | 0.001 102 3          | tons (short)                 | 1 ton (short)                  | <b>907.184 74</b>     | kg              |
| 1 t                            | 1.102 311 3          | tons (short)                 | 1 ton (short)                  | <b>0.907 184 74</b>   | t               |
| 1 kg                           | 0.000 984 21         | tons (long)                  | 1 ton (long)                   | <b>1016.046 908 8</b> | kg              |
| 1 t                            | 0.984 206 5          | tons (long)                  | 1 ton (long)                   | <b>1.016 046 90</b>   | t               |
| CONCENTRATION                  |                      |                              |                                |                       |                 |
| 1 g/t                          | 0.029 166 6          | ounce (troy)/<br>ton (short) | 1 ounce (troy)/<br>ton (short) | 34.285 714 2          | g/t             |
| 1 g/t                          | 0.583 333 33         | pennyweights/<br>ton (short) | 1 pennyweight/<br>ton (short)  | 1.714 285 7           | g/t             |

## OTHER USEFUL CONVERSION FACTORS

|                                | <i>Multiplied by</i> |                               |
|--------------------------------|----------------------|-------------------------------|
| 1 ounce (troy) per ton (short) | 31.103 477           | grams per ton (short)         |
| 1 gram per ton (short)         | 0.032 151            | ounces (troy) per ton (short) |
| 1 ounce (troy) per ton (short) | 20.0                 | pennyweights per ton (short)  |
| 1 pennyweight per ton (short)  | 0.05                 | ounces (troy) per ton (short) |

*Note: Conversion factors which are in bold type are exact. The conversion factors have been taken from or have been derived from factors given in the Metric Practice Guide for the Canadian Mining and Metallurgical Industries, published by the Mining Association of Canada in co-operation with the Coal Association of Canada.*